T.O. 00-20-14

TECHNICAL MANUAL

AIR FORCE METROLOGY AND CALIBRATION PROGRAM

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 98, CONSISTING OF THE FOLLOWING:

*Zero in this column indicates an original page

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

SECTION 1

INTRODUCTION

1.1 PURPOSE. This Technical Order (T.O.) holds the policy, methods and procedures for the management of the Air Force Metrology and Calibration (AFMETCAL) Program. This program is established and directed by AFI 21-113, *Air Force Metrology and Calibration (AFMETCAL) Program.*

1.2 GENERAL. The AFMETCAL Program is an Air Force program that provides measurement standards and equipment, professional and technical metrologists, performing work centers (PWCs), a system of worldwide Precision Measurement Equipment Laboratory (PMEL) facilities, measurement equipment users, calibration data, and integrated planning. This program ensures the reliability and accuracy of systems, subsystems, and equipment. The program provides for the calibration and repair of Test, Measurement, and Diagnostic Equipment (TMDE). It also ensures measurement traceability of the TMDE through the Air Force Primary Standards Laboratory (AFPSL) to National Institute of Standards and Technology (NIST) or other AFMETCAL DET 1 approved sources. To accomplish this traceability, the AFMETCAL program requires that Air Force users and Precision Measurement Equipment Laboratories (PMELs) obtain calibration service from Air Force PMELs or the AFPSL as appropriate. AFMETCAL Det 1 must approve obtaining calibration service from other sources. The responsibilities of organizations in the AFMETCAL Program are identified in AFI 21-113.

1.2.1 AFMETCAL Detachment 1. AFMETCAL Det 1 serves as the Air Force technical authority on Metrology issues and is the Air Force single point of contact for calibration services and traceability of measurements to NIST. AFMETCAL Det 1 has the responsibility to assign calibration and repair responsibility determinations for TMDE. Responsibility determinations are published in T.O. 33K-1-100-1 and T.O. 33K-1-100-2 (contained in T.O. 33K-1-100-CD-1), Calibration and Measurement Summary (CMS) T.O.s, and T.O. 33K-1-100-2MT-0 (the electronic version of T.O. 33K-1-100-2 and certain CMS workload summary tables). All references to T.O. 33K-1-100-2 and CMS T.O.s shall also apply equally to the corresponding electronic versions in T.O. 33K-1-100-2MT-0 (the "PAMS Tape").

1.2.2 Air Force Primary Standards Laboratory (AFPSL) Division. The Air Force Primary Standards Laboratory (AFPSL) is responsible for maintaining the Air Force Measurement Standards. The standards are traceable to NIST or other sources as approved by AFMETCAL Det 1. These Air Force Measurement Standards are used to ensure the accuracy and traceability of the Base Measurement Standards. The Base Measurement Standards are provided to the PMELs.

1.2.3 Precision Measurement Equipment Laboratories (PMELs). PMELs are established at selected installations. The PMEL is the base-level AFMETCAL Program focal point. It is the activity authorized to possess and use base measurement standards. Operational details of the program are set forth in Section 3 of this T.O. and related command directives.

1.2.4 Program Controls. Commanders of the United States Air Force, Air Force Reserves and Air National Guard activities shall establish controls to ensure that TMDE, under their control, is repaired, calibrated, and certified. Commanders shall ensure that PMEL facilities are built according to AFMAN 32-1094, *Criteria for Air Force Precision Measurement Equipment Laboratory Design and Construction*, and operated according to Section 8 of this T.O. AFI 21-113, along with this T.O., applicable CMS T.O.s, T.O. 33K-1-100-1 and T.O. 33K-1-100-2, and command directives prescribe those controls. All TMDE in use shall be calibrated at regularly scheduled intervals called out in CMS T.O.s, T.O. 33K-1-100-1and T.O. 33K-1-100-2. Authorized exceptions to calibration are identified in Section 3 of this T.O., any applicable CMSs, and T.O. 33K-1-100-2.

1.2.5 Other DoD Services Calibration Laboratories. The use of other DoD services calibration laboratories is only authorized when approved by the applicable MAJCOM FAM and AFMETCAL Det 1. The Army, Navy, and Marines all operate calibration laboratories using similar measurement techniques and management concepts, which provide measurement traceability to NIST. This policy does not extend to other government calibration laboratories. Units requesting support from another service shall follow the guidance in Section 4 which describes how to establish support agreements in addition to the guidance contained in the interservice support agreement regulations.

1.3 SCOPE. This T.O. applies to all activities that possess, use, calibrate, certify, and maintain TMDE.

1.4 DEFINITIONS. The following definitions shall apply for the purpose of this T.O.

1.4.1 Absolute Measurement Standard. Designated measurement standards based on the absolute value of natural physical constants whose values can be accurately repeated under controlled conditions. Examples are Laser Length Standards, Josephson Junction Voltage Standards, and Hall Effect Magnetic Field Standards.

1.4.2 Air Force Primary Standards Laboratory (AFPSL). The highest level standards laboratory in the AFMETCAL Program. It maintains Air Force measurement standards certified by the NIST, the US Naval Observatory (USNO), or other AFMETCAL Det 1 recognized standards.

1.4.3 ANSI/NCSL Z540-1-1994. The American National Standards Institute published, "Calibration Laboratories and Measuring and Test Equipment - General Requirements ". The AFMETCAL program does not approve this standard as the sole requirement for operating a USAF PMEL.

1.4.4 Calibration. Calibration is a comparison between items of equipment, one of which is a measurement standard of known accuracy, to detect, correlate, adjust and report any variation in the accuracy of the other item(s).

1.4.5 Calibration, Limited. Calibration of TMDE to less than the accuracy or functional capabilities specified in the authorized calibration procedure or data.

1.4.6 Calibration, Special. Calibration of TMDE to all specifications called for in the authorized calibration procedure plus additional requirements.

1.4.7 Calibration and Measurement Requirement Summary (CMRS). This is a three category, in-line, summary of measurement parameters. Normally, a Department of Defense (DoD) system contractor prepares the CMRS. A CMRS identifies all measurement requirements within a specific system or item of equipment. The CMRS further displays the proposed solutions for maintaining the system measurement requirements within the stated limits. It is also used to identify the need for new calibration standards. This data is provided to AFMETCAL Det 1, 813 Irving-Wick Dr W, Ste 4 M, Heath OH, 43056-6116. AFMETCAL Det 1 uses it for ensuring calibration supportability and planning for PMEL support for a particular weapon system/subsystem. AFMETCAL Det 1 maintains the CMRS.

1.4.8 Calibration and Measurement Summary (CMS). A T.O. which identifies calibration support necessary to ensure the operational readiness of a specific weapon system or subsystem. The summary describes the calibration concept and is calibration authority for the applicable weapon system or subsystem. The CMS is printed as a weapon system or 33K series technical order. AFMETCAL Det 1 maintains all Air Force CMSs.

1.4.9 Calibration Certificate or Calibration Report. Also referred to as, "Report of Measurement". It is a document containing data relevant to the calibration of a specific test instrument or standard. The AFMETCAL Program does not differentiate between a calibration certificate and a calibration report provided the document contains the required information to interpret the calibration results for the specific calibration.

1.4.10 Calibration Chart. A chart prepared for a specific item. It shows the difference between the nominal value and the actual value of a measurement or group of measurements.

1.4.11 Centralized Intermediate Repair Facility (CIRF). Centralized intermediate repair facilities (CIRFs) provide regional intermediate-level maintenance repair support for designated USAF units. This regional repair capability replaces the current decentralized maintenance concept in which base-level units perform all intermediate-level maintenance for deployed aircraft.

1.4.12 Certification. The documented designation that standards and TMDE have been calibrated and meet established technical requirements. It can also mean that a calibration laboratory (PMEL or AFPSL) has successfully fulfilled the AFMETCAL assessment criteria of this T.O.

1.4.13 Commercial Calibration. Calibration of TMDE obtained from a commercial source. This is to be considered as a last option only after organic support options have been considered. AFMETCAL Det 1 approval is required prior to obtaining calibration from a commercial source.

1.4.14 Contract Calibration. Commercial calibration contracted and funded by AFMETCAL Det 1 or the user. Part numbers identified as Note 49 (N49) Note 59 (N59) and Note 64 (N64) for calibration support responsibility are contracted and funded by AFMETCAL Det1. Part numbers identified as 'CONTRACT" are contracted and funded by the user.

1.4.15 Contingency Calibration Operation. A deployed calibration capability that may include but is not limited to RASCAL, TFCU, mobile calibration teams, combined operations with a FMS country, etc. See Figure 1-2 for the PMEL support matrix.

	DEPLOYED TMDE THAT IS NOT RAINBOWED	**DEPLOYED TMDE THAT IS RAINBOWED**	**TMDE PERMANENTLY ASSIGNED WITHIN AOR**
STEADY-STATE / ROTATIONAL LOCATIONS (e.g., ONW, OSW, HOME STATION, etc.)	Customer Uses Reachback Support From Their Home Station	Customer Uses Steady State CIRF[1, 3] OR Customer Uses Reachback Support From Their Home Station	Customer Uses Nearest USAF Activity With PMEL Capability[4] OR Customer Uses Contingency State CIRF[1, 2]
CONTINGENCY / CRISIS LOCATIONS (e.g., OEF, ONE, etc.)	Customer Uses Nearest USAF Activity With PMEL Capability OR Customer Uses Contingency State CIRF[1, 2]		

NOTES:
1. CIRF types are peacetime, steady state, contingency, and Major Theater War (MTW). We are executing steady state and contingency CIRFs only.
2. Contingency CIRFs provide regional intermediate repair to support small-scale rapid response deployments to multiple global locations.
3. Steady state CIRFs provide regional intermediate repair to support AEF/AEW rotations.
4. PMEL initiates action with local wing manpower office to increase total manpower requirements.

Figure 1-1
PMEL SUPPORT MATRIX

1.4.16 Correction Chart. A chart prepared for a specific item, which shows corrections that must be applied to indicated values to obtain true values.

1.4.17 Equipment Types:

a. Mission Equipment. Part of operational ground or airborne systems.

b. Support Equipment (SE). A broad category of equipment and tools used to verify and maintain mission equipment. Support equipment can include equipment used to verify the operation of other support equipment. SE is categorized as either TMDE or Non-TMDE. The AFMETCAL Program is primarily concerned with the support equipment categorized as TMDE.

c. Test, Measurement, and Diagnostic Equipment (TMDE). Those devices used to maintain, evaluate, measure, calibrate, test, inspect, diagnose, or otherwise examine materials, supplies, equipment, and systems to identify or isolate actual or potential malfunction, or decide if they meet operational specifications established in technical documents. ANSI/NCSL Z540-1-1994 and ISO 17025 refer to this equipment as "measuring and test equipment."

d. Non-TMDE. SE not meeting the TMDE definition. This equipment does not require calibration and is the responsibility of the user.

e. Precision Measurement Equipment (PME). For purposes of this T.O., PME is the same as TMDE. This is the former title for TMDE.

1.4.18 ISO Standard 17025. The international standard for commercial metrology, "General Requirements for the Competence of Calibration and Testing Laboratories" which includes the relevant requirements of ISO 9000 series standards. The AFMETCAL program does not approve this standard as the sole requirement for operating a USAF PMEL.

1.4.19 Measurement or Reference Standards: Equipment that serves as the basic means by which the accuracy and traceability of a precision measurement is derived. The typical chain of measurement standards is shown in Figure 1-1. The following are types of standards:

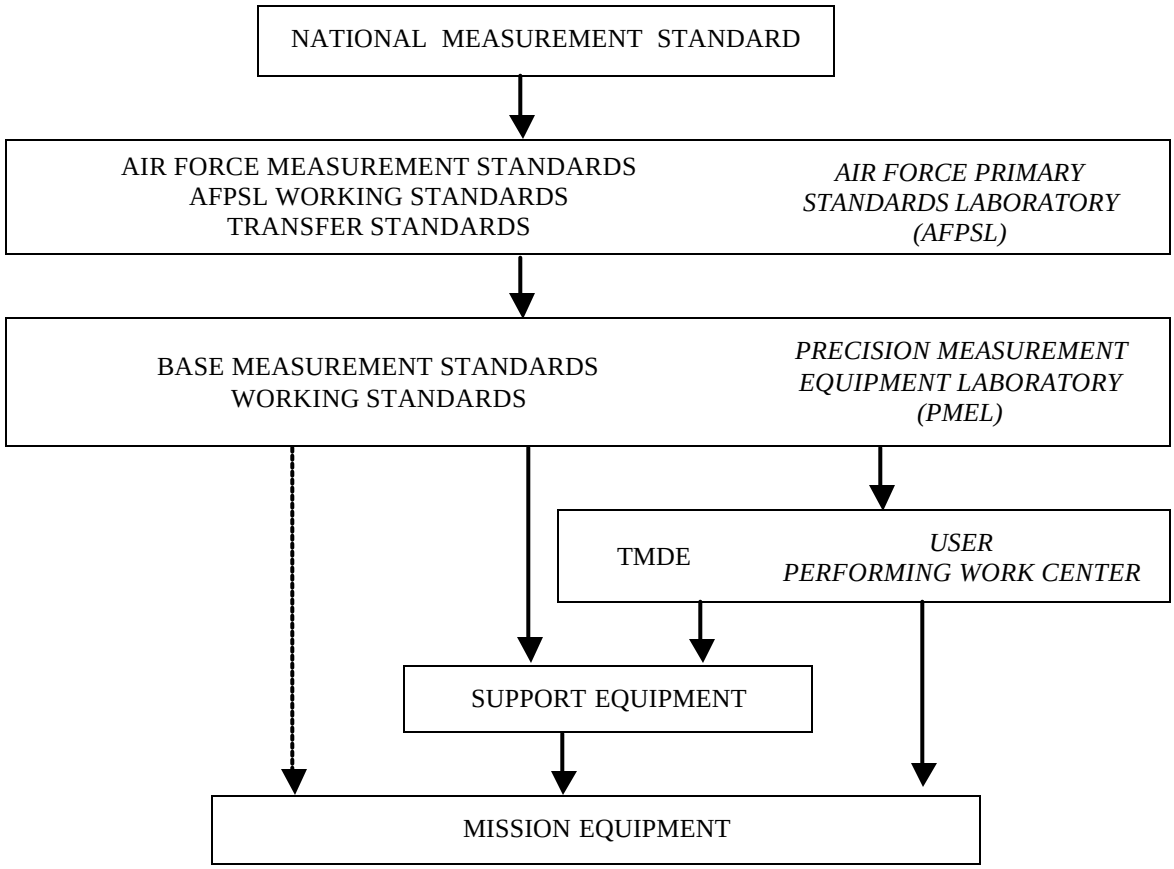

Figure 1-2
MEASUREMENT TRACEABILITY OF THE AIR FORCE
METROLOGY AND CALIBRATION PROGRAM

a. National Measurement Standards. Equipment or physical constants identified and normally used by the NIST to serve as a basic measurement reference for use throughout the United States and at U.S. installations/activities overseas.

b. Air Force Measurement Standards. Equipment certified by NIST or other AFMETCAL Det 1 approved sources and used by the AFPSL as a basic measurement reference for the Air Force.

c. AFPSL Working Standards. TMDE certified by the AFPSL and used to calibrate other TMDE.

d. Base Measurement Standards. Equipment certified by the AFPSL or AFMETCAL Det 1 approved sources for use by an Air Force PMEL as a measurement reference.

e. Working Standards. TMDE certified by PMEL and used to calibrate other TMDE.

f. Transfer Standard. A measurement standard calibrated by the AFPSL and circulated to multiple PMELs to calibrate base measurement standards or working standards to minimize PMEL down time. A transfer standard is calibrated by the AFPSL, forwarded to a PMEL, used by the PMEL to calibrate a base or working standard, and then returned to the AFPSL of forwarded to the next PMEL as appropriate. PMELs are responsible to fund shipping costs to forward transfer standards to the AFPSL or the next PMEL as appropriate. T.O. 33K-2-11 contains detailed instructions and information for Transfer Standards.

g. Exchange Standard. A base measurement standard calibrated by the AFPSL through a calibrate and replace methodology to minimize PMEL down time. A base measurement standard is calibrated by the AFPSL and sent to a PMEL to replace a like base measurement standard before is calibration has expired. The base measurement standard whose calibration interval is expiring then returned to the AFPSL to be calibrated and forwarded to another PMEL. The PMEL is responsible to fund shipping costs to return exchange standards to the AFPSL. T.O. 33K-2-11 contains detailed instructions and information for Exchange Standards.

1.4.20 Metrology. The science or system of weights and measures used to determine conformance to technical requirements including the development of standards and systems for absolute and relative measurements.

1.4.21 Precision Measurement Equipment Laboratory (PMEL). A laboratory authorized to own and use base measurement standards to maintain working standards. The working standards are used along with PMEL-owned TMDE to maintain (troubleshoot, align, repair, and calibrate) TMDE designated as PMEL responsibility. Authorizations for PMEL equipment and facility requirements are tailored to meet specific requirements for supported missions. PMELs are the base-level link for measurement transfer and maintenance self-sufficiency for all systems in the Air Force. The following are the types of PMELs:

a. Type IIA. A base level PMEL with a 68°F room providing support to an Air Logistics Center (ALC) and/or a large geographical area. These PMELs are operated at each ALC by AFMC. PACAF and USAFE theater support commands operate others located at Kadena AB JA, Elmendorf AFB AK, and Feltwell RAF UK.

b. Type IIB. A base-level PMEL which can support aircraft, missiles, ground systems, and/or other equipment on base or in the local area. This includes the Rapid Assistance Support for Calibration (RASCAL) sets. Due to its mission, the RASCALcan be co-located with a Type II () PMEL.

c. Type IIC. A base level PMEL with a 68°F room typically providing support to research, development, test or evaluation programs, as well as other operational and support functions.

d. Type III. A PMEL tailored to satisfy a specific mission and normally receiving calibration support from a Type II () PMEL. A Type III PMEL is not authorized at an installation where a Type II PMEL exists. This includes the PMEL on the US Naval ship, Observation Island.

e. Type IV. A PMEL established to support a specific weapon system. It uses a transportable measurement system in both fixed and deployed locations. A Type IV PMEL receives calibration support from a Type II () PMEL. It may be located at an installation where a Type II () PMEL exists.

f. Type V. A Calibration and Repair capability established at an ALC in addition to the Type IIA PMEL to support depot specific and on-site TMDE. A Type V receives calibration support from the Type IIA PMEL.

1.4.22 PMEL Manager. Synonymous with PMEL superintendent, PMEL branch chief, TMDE branch chief, TMDE flight chief, TMDE section chief and Laboratory Manager. This is the individual responsible for day-to-day management and operation of the PMEL and its associated work centers, such as production control, quality program and material control.

1.4.23 PMEL Mobile and On-Site Measurement Capabilities:

a. Rapid Assistance Support for Calibration (RASCAL). A portable PMEL designed for rapid deployment to support emergency calibration needs. It consists of a set of 5 environmentally controlled shelters containing measurement standards and other TMDE. The shelters are joined together when in use, but they can be taken apart and airlifted to any location as needed.

b. Jet Engine Test Stand Calibrator (JETSC). TMDE and accessories needed to perform on-site calibration of jet engine test stands. They are housed in a trailer or ruggedized cases, which has both a work and a storage area.

c. Portable Automatic Test Equipment Calibrator (PATEC). The PATEC is used to calibrate Automatic Test Equipment (ATE) on site. The PATEC consists of a set of portable standards. The portable standards are IEEE-488 compatible wherever possible. A Core PATEC is designed to meet the calibration needs of a variety of test stations.

d. Transportable Field Calibration Unit (TFCU). Working standards in carrying cases selected for their ability to function within given performance tolerances without benefit of a controlled PMEL environment. The TFCU is used to calibrate TMDE located at remote sites or bases.

1.4.24 PMEL Quality Assurance (PQA) Evaluator. Highly qualified, 7-skill level or equivalent when possible, PMEL personnel assigned to the PMEL. Selected by PMEL management and appointed in writing. PQA evaluators are the only personnel designated to perform Quality Reviews, Process Reviews, and Standard Reviews applicable to the Quality Program outlined in this T.O.

1.4.25 Reachback. The process of obtaining products, services, and applications or forces, equipment or materiel from Air Force organizations that are not forward deployed. This capability allows commanders to obtain or coordinate support form units not physically located with the forward force.

1.4.26 Shall. Shall is a directive statement. Reference T. O. 00-5-1.

1.4.27 Traceability. The ability to relate individual measurement results to national standards or nationally accepted measurement systems through an unbroken chain of comparisons all having stated uncertainties. Mandatory USAF traceability is accomplished as shown in Figure 1-1 or as approved by AFMETCAL Det 1.

1.4.28 User. User refers to the using activity or owning organization that is responsible for calibration and maintenance of items designated "USER" responsibility in a CMS or T.O. 33K-1-100-2. In most cases, the 'user' and the 'owner' are the same. In general, the 'user' is the activity that physically uses the item. The 'owner' is the organization that owns the item via a supply account. The 'user' performs USER calibrations or coordinates with the PMEL for assistance when resources are not available. The PMEL will assist to identify required equipment or approved sources or support. As a last resort, the PMEL may perform the calibration. The owner is responsible for any funding associated with these efforts.

1.5 PROGRAM ACRONYMS :

a.	AEF	Air Expeditionary Force
b.	ASC	Allowance Source Code
c.	CAP	Corrective Action Plan
d.	CBU	Calibrate Before Use
e.	CFR	Code of Federal Regulations
f.	CIRF	Centralized Intermediate Repair Facility
g.	CPIN	Computer Program Identification Number
h.	ECS	Environmental Control System
i.	EME	Equipment Management Element
j.	ESD	Electrostatic Discharge
k.	FMS	Foreign Military Sales
l.	GEOLOC	Geographic Location
m.	HIR	High Intensity RADIAC
n.	ICO	Initial Calibration Only
o.	IM	Item Manager
p.	ISA	Interservice Support Agreement

q.	JCN	Job Control Number
r.	JDD	Job Data Description
s.	JETSC	Jet Engine Test Stand Calibrator
t.	MAP	Measurement Assurance Program
u.	MCA	Measurement Capability Assessment
v.	MDC	Maintenance Data Collection
w.	MOB	Mobility
x.	NC	Nonconformity
y.	NCR	No Calibration Required
z.	NEC	No End Item Calibration
aa.	NHA	Next Higher Assembly
bb.	NPC	No Periodic Calibration
cc.	NRC	Nuclear Regulatory Commission
dd.	OEM	Original Equipment Manufacturer
ee.	OWC	Owning Work Center
ff.	PAMS	PMEL Automated Management System
gg.	PM	Program Manager
hh.	PNC	Process Nonconformity
ii.	PT/MAP	Proficiency Testing/ Measurement Assurance Program
jj.	PQA	PMEL Quality Assurance
kk.	PR	Process Review
ll.	PTRS	Precise Time and Reference Station
mm.	PWC	Performing Work Center
nn.	QDR	Quality Deficiency Report
oo.	QNC	Quality Nonconformity
pp.	QP	Quality Program
qq.	QR	Quality Review
rr.	RC	Root Cause
ss.	SA	Security Assistance
tt.	SATAF	Site Activation Task Force
uu.	SBSS	Standard Base Supply System
vv.	SICL	See Individual Component Listing
ww.	SICW	See Item Calibrated With
xx.	SR	Standard Review
yy.	TCM	Technical Content Manager
zz.	TI	Test Instrument

aaa.	TRC	Technical Repair Center
bbb.	WRM	War Reserve Material
ccc.	WUC	Work Unit Code

SECTION 2

AFMETCAL PROGRAM ORGANIZATION AND INTERFACE

2.1 GENERAL. The AFMETCAL Program includes AFMETCAL Det 1, PMELs and their resources, and the TMDE in the Air Force. The directives that provide the policy and guidance are also part of the program. The purpose of the AFMETCAL Program is to ensure that all Air Force TMDE used to make measurements is accurate, reliable, provides standardized measurements, and is traceable through the AFPSL to NIST or other AFMETCAL Det 1 approved sources. This TMDE is used to make sure that each system and subsystem is accurate and reliable and ensures that they properly interface with other systems.

2.2 AFMETCAL PROGRAM.

2.2.1 Figure 2-1 Description. Figure 2-1 depicts each element of the AFMETCAL Program and the interrelationship of major Air Force organizations. The center circle identifies the major elements of the AFMETCAL Program: AFMETCAL Det 1, the PMELs, and TMDE users. The focus of the AFMETCAL Program is to ensure accuracy and traceability of TMDE. This TMDE is used to ensure the accuracy and reliability of all Air Force systems. The resources needed to operate the AFMETCAL Program are identified in the rectangles. In cooperation with the other elements, AFMETCAL Det 1 provides program guidance, PMEL standards, traceability of standards, calibration procedures, PMEL evaluations, metrology engineering support, and determines calibration requirements of systems. The PMELs are the performing work centers containing the personnel that calibrate, certify, and repair the TMDE owned and used by Air Force organizations. The AFMETCAL program requires users and PMELs to obtain calibration service from Air Force PMELs or the AFPSL as appropriate. AFMETCAL Det 1 must approve obtaining calibration service from other sources. The users of TMDE utilize their PMEL calibrated items to verify their support equipment (test benches, simulators, etc.) as well as major systems or subsystems. Users of the TMDE are assigned owning work center (OWC) codes.

2.2.2 Resources used by AFMETCAL Program. There are four primary groups of resources used by the AFMETCAL Program to do its mission (personnel, equipment/material, documentation, and facilities). A basic need is sufficient personnel, having the necessary education, training, technical knowledge and experience for their assigned functions. These personnel require directives/procedures, material, and facilities. Calibration procedures provide the calibration methods. The PMEL requires parts and material to perform calibration and repair of TMDE. They also need their own measurement standards. The PMEL facility has some special requirements based on the system(s) it supports. The requirements of the program are based upon the measurement needs, and the accuracy of the measurements required of all systems supported by the Air Force. The outer ring of Figure 2-1 identifies the organizations that interface with the AFMETCAL Program. They provide, or coordinate, in the provisioning of the resources for the program. The outer ring of Figure 2-1 also shows the planning required to ensure that the proper AFMETCAL Program support is available. That support is needed for all systems from the time a system is under development through its entire life cycle.

2.2.3 Funding. Material and personnel needs are satisfied according to the amount of funding available.

2.2.3.1 Funds for daily operating expenses of the PMELs are provided by the owning command. They generally come from operation and maintenance (O&M) appropriations. Business operating funds are furnished for AFMC depot supported workloads. Air Force regional workload support is generally funded by O & M appropriations.

2.2.3.2 Centrally procured investment (equipment) item funding is provided through AFMC.

2.2.3.3 Centrally procured expense (parts) item funding comes from the USAF Stock Fund.

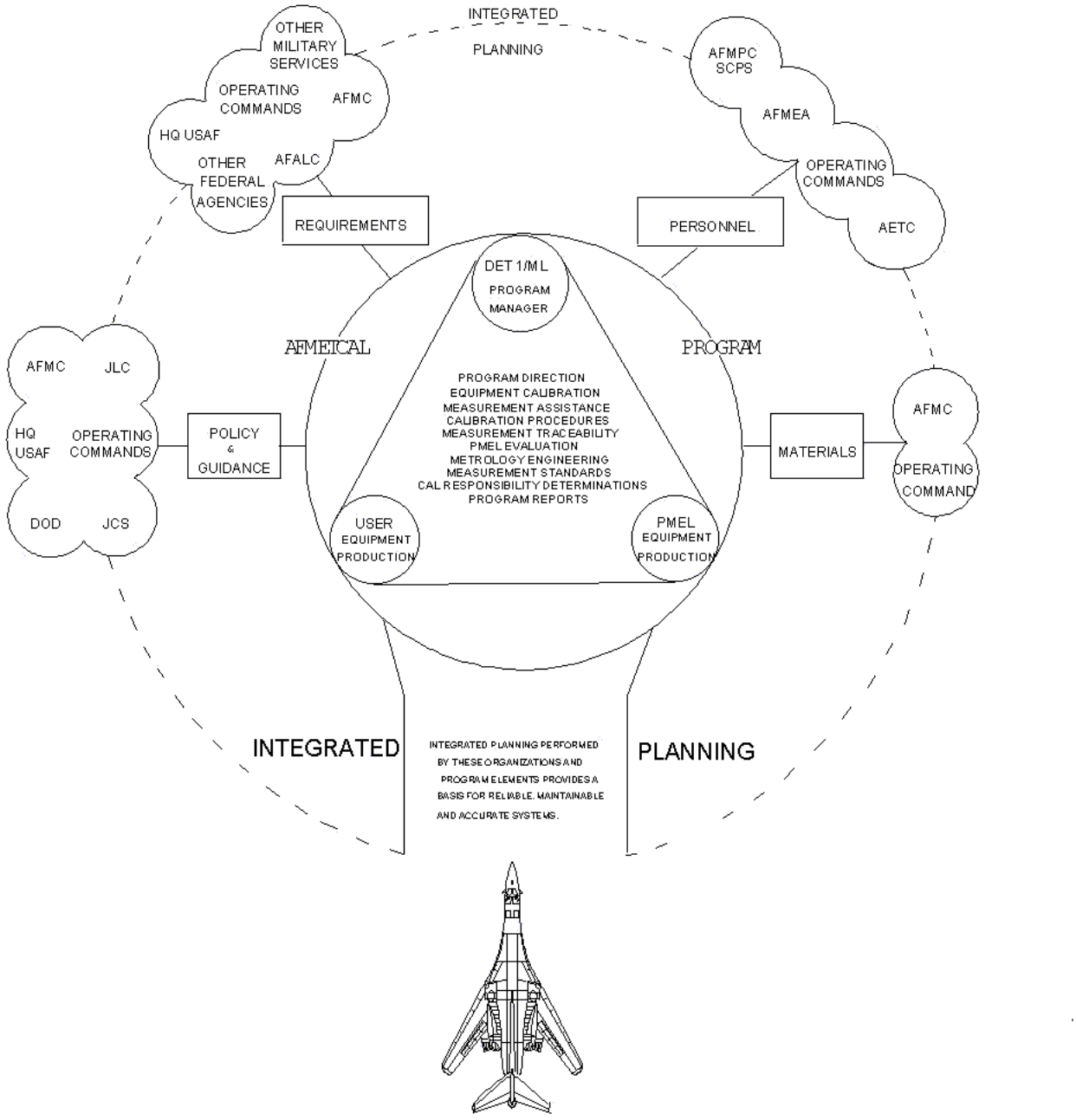

Figure 2-1
AFMETCAL PROGRAM RESOURCES AND PLANNING INTERFACES

2.2.3.4 Operating command or base procured investment and expense items are generally funded from (O&M) and equipment funds.

2.2.3.5 Facility funds are part of 3300 (Military Construction – Air Force) appropriations. This includes major and some minor construction projects as well as facility project planning efforts.

2.2.3.6 AFMC is responsible for funding research and development projects. This includes support required for those projects turned over to other operating commands.

2.3 <u>PROGRAM POLICY AND DIRECTION</u>. HQ USAF/ILMM provides program policy in AFI 21-113, Air Force Metrology and Calibration (AFMETCAL) Program.

2.3.1 Requirements for TMDE Support from PMELs. PMELs and TMDE user organizations shall periodically review and update war plans related to their operations. The review shall consider where, who, what, and how TMDE shall be supported. Of special concern shall be TMDE that is mission essential to systems and subsystems required to meet Designed Operational Capability (DOC). This is necessary for mission capability and unit combat readiness reporting under AFI 10-201, *Status of Resources and Training System.*

2.3.2 Periodic Reports Utilized. AFMETCAL Det 1 and the PMEL functional area managers utilize periodic reports (see PMEL Reports, Section 6) submitted by each of the PMELs to assist in managing the program.

2.4 PROGRAM REQUIREMENTS. New systems or improvements in weapon system performance are major factors in upgrading the measurement capability of supporting PMELs. AFMETCAL Det 1 has the responsibility to review the measurement requirements of all Air Force systems. This normally happens through the review of Support Equipment Recommendation Data (SERD) and/or CMRS documents.

2.4.1 Support Equipment Recommendation Data (SERD). The SERD review process is used to justify the weapon system support equipment. SERDs are reviewed by Operating Commands, the acquisition agency, the item manager, and AFMETCAL Det 1. Calibration responsibility determinations are made for approved SERDs. Calibration procedure requirements are established when necessary.

2.4.2 Calibration and Measurement Requirement Summary (CMRS). The CMRS documents are only required on complex systems. The completed document identifies the measurement requirements. They extend from the weapon system through the support equipment to the PMEL measurement standards.

2.4.3 Calibration and Measurement Summary (CMS). The CMS is published as a T.O. and details the measurement accuracy requirements on a complex system. AFMETCAL Det 1 is responsible for the technical adequacy of the CMRS and the subsequently published CMS. AFMETCAL Det 1 is also responsible for ensuring that measurement traceability exists from the national level to the system measurement. This includes the AFPSL capability. If the system has no unique or complex support requirements, the applicable support equipment is added to T.O. 33K-1-100-2.

2.4.4 Measurement Upgrade Identification. Necessary improvements in PMEL measurement capability are identified early in the AFMETCAL Det 1 review. This is done in the calibration responsibility determinations and the calibration procedure preparation process. If additional measurement capabilities are required, the measurement standard shall be acquired and distributed by AFMETCAL Det 1 to the appropriate PMELs. If only national stock listed test equipment is required; the equipment shall be added to the applicable Allowance Source Code (ASC). The equipment shall be requisitioned by the PMEL. Normally, workload summaries derived from the SERD and CMRS reviews, are distributed to the operating commands. They are distributed at various times during the life cycle of the system to allow for PMEL support planning. Since two PMELs rarely support the same type systems, very few PMELs have the exact same measurement capability. Most have the same basic capability.

2.5 PROGRAM MATERIAL. Material is a broad category. It includes facilities as well as equipment, parts, and other items. It is used to support the AFMETCAL Program mission at all levels.

2.5.1 PMEL Establishment/Closing. Commands shall coordinate any change in the status of any PMEL with AFMETCAL Det 1 and receive final approval from HQ USAF/ILMM. This includes requirements for new PMELs, elimination of any existing PMEL, or a PMEL location change.

2.5.2 PMEL Facility Requirements Documentation. AFMETCAL Det 1 specifies PMEL facility requirements and performs reviews of facility project documentation. Design and construction are an owning command responsibility. AFMAN 32-1094, *Criteria for Air Force Precision Measurement Equipment Laboratory Design and Construction* and AFI 32-1024, *Standard Facility Requirements*, are some of the major publications involved. T.O. 00-20-14 (PMEL Facility Operational Requirements, Section 8) contains facility operating parameters for PMELs.

2.5.3 Equipment. Equipment is obtained through the Air Force Equipment Management System (AFEMS) by ASC authorizations from ALC Commodity Management, AFMETCAL Det 1, or local purchase.

2.5.4 Expense Items. Expense items (parts, tools, furnishings, etc) are obtained through the Standard Base Supply System (SBSS) from ALC Commodity Management, local purchase, or local manufacture.

2.5.5 Technical Data. Technical data is obtained from the Air Force T.O. System, AFMETCAL Det 1, other DoD Agencies, or local purchase.

2.5.6 Management Information System (MIS). Software and hardware to provide PMELs with inventory, processing, calibration scheduling, job data documentation, and quality assurance functionality.

2.6 PERSONNEL. PMELs shall have sufficient personnel, having the necessary education, training, technical knowledge and experience for their assigned functions. PMEL managers shall ensure that training of personnel is kept up-to-date and consistent with employee assignments and development.

2.6.1 Training Records. Training records shall be maintained on the relevant qualifications, training, skills and experience of technical personnel. The documentation may be maintained in electronic or traditional format. Regardless of the format, records shall be available and periodically reviewed by the employee and PMEL management. The term training in this context is defined as "records maintained in the PMEL that document management approval for specific technicians to perform specific tasks or types of tasks." These records (however named) should be of sufficient detail to provide confidence in the task competence of assigned personnel. Military specialty training standards or similar documents are a convenient method to satisfy this requirement.

2.7 PROGRAM INTEGRATION. TMDE requiring support drives all resource needs and normally comes from three sources. They are (A) centrally procured items resulting from a systems acquisition, (B) centrally procured replacement buys, and (C) locally-procured TMDE.

2.7.1 AFMC Centrally Procured TMDE. Close working relationships among the System Program Directors (SPDs), AFMETCAL Det 1's measurement area and systems planners, ALC Commodity Managers, Product Group Managers, Material Group Managers, AETC/TT, and the using commands are necessary to ensure proper planning, programming, budgeting, acquisition, training, and distribution of resources needed to support this TMDE are provided.

2.7.2 Centrally Procured Replacement TMDE. Close working relationships among ALC Commodity Managers, AFMETCAL Det 1 measurement area planners, Product Group Managers, Material Group Managers, AETC/TT, and the using commands are necessary to ensure planning, programming, budgeting, acquisition, training and distribution of resources needed to support this TMDE are provided.

2.7.3 Locally Procured TMDE. The local user/buyer funds support requirements. Before contracting for TMDE, the buyer shall coordinate support requirements with PMEL. See TMDE User Responsibilities in Section 3 for more information.

SECTION 3

OPERATION

3.1 CALIBRATION OF STANDARDS AND OTHER TMDE. The PMELs, which are maintained, manned, and operated by the MAJCOMS, are responsible for calibrating and/or repairing standards and other TMDE specified in CMS T.O.s, T.O. 33K-1-100-1, and T.O. 33K-1-100-2. PMELs are also responsible for other workload that may be assigned by the MAJCOM. Policy, procedures, intervals, and responsibilities for the maintenance, calibration, and certification of standards and TMDE are identified in this T.O., T.O. 33-1-27, T.O. 33K-1-100-1, T.O. 33K-1-100-2, other applicable command directives, and weapon or support system CMS T.O.s. These T.O.s and directives shall be used for all TMDE used to make qualitative/quantitative measurements on operational systems and equipment. All TMDE having an effect on the accuracy and validity of calibrations shall be calibrated. Any standard or TMDE that has exceeded its calibration due date or is otherwise judged unreliable shall be recalled or removed from service.

3.1.1 Valid and Accurate Calibration Requirements. To assure valid and accurate calibrations are performed, it is necessary to:

a. Comply with appropriate calibration authority.

b. Use technically qualified personnel.

c. Use equipment called for in the calibration authority or substitute equipment with required functions, ranges, and test uncertainty ratios.

d. Perform calibrations in an environmentally controlled atmosphere.

3.1.2 Calibration Authority Precedence. Calibration authority selection shall be made in accordance with the following precedence:

First. CMS (T.O. 33K-1-100-2MT-0*) (Applicable to TMDE used solely to support a system referenced in the CMS). TMDE applicable to more than one CMS shall be calibrated to meet all CMS requirements and noted as required in the SPECIAL block of the certification label.

Second. T.O. 33K-1-100-2** (T.O. 33K-1-100-2MT-0*).

Third. T.O. 33K-1-100-1 Section 3-1**, if applicable.

Fourth. Other official DoD calibration procedures.

Fifth. Equipment maintenance T.O.

Sixth. Commercial Publications or Commercial Data.

* T.O. 33K-1-100-2MT-0 contains the electronic version of T.O. 33K-1-100-2 and certain CMS workload summaries, and has synonymous corresponding precedence.

** T.O. 33K-1-100-CD-1 contains T.O. 33K-1-100-1 and T.O. 33K-1-100-2.

3.1.3 Local K100. A locally managed addendum to T.O. 33K-1-100-2 that contains the following inventory items:

a. Items that have an AFTO Form 45 being processed. These items must be purged when they become listed in a CMS or T.O. 33K-1-100-2.

b. Items that have no identifiable part number or manufacture and have been calibrated under the provisions for "Special" calibrations.

c. Items from FMS countries.

d. Items that do not belong to the Air Force, ANG, or AFRC. (Support agreements, NASA, DOE, etc.)

e. Locally manufactured items determined to be TMDE. (Reference T.O. 33K-1-100-1 Section 1.)

3.1.4 AFPSL Requirements. The AFPSL evaluates many first-article items and is responsible for acceptance testing of certain new items entering the inventory. This requires some deviation from normal directives since formal 33K procedures may not exist for such items. The process for conducting first-article and acceptance testing shall be documented.

3.1.5 Calibration Responsibility Determinations. TMDE calibration and repair responsibility determinations are managed by AFMETCAL Det 1 and are published in CMS T.O.s and T.O. 33K-1-100-2.

3.1.5.1 Request for Calibration Responsibility Determinations. If the TMDE is not listed in the CMS or T.O. 33K-1-100-2 as prescribed in T.O. 33K-1-100-1, the PMEL shall submit an AFTO Form 45, *Request for Calibration Responsibility Determination*, to AFMETCAL Det 1 in accordance with instructions in Section 5 of this T.O. The PMEL shall assist the user in maintenance and calibration; however, the maintenance and calibration of the equipment shall be the responsibility of the user and the procuring agency until the calibration responsibility decision is made. While awaiting the calibration responsibility determination, as published in the CMS or 33K-1-100-2, the item may be calibrated using commercial data as the calibration authority.

3.1.5.2 Non-Air Force TMDE. Ensure requests for calibration responsibility determinations, AFTO Form 45s, are not submitted for equipment owned and used by departments outside the Air Force. Such a customer is responsible to give the PMEL the capability to support new equipment, if the PMEL does not already have it.

3.1.5.3 Responsibility Determination Exceptions. There may be instances where individual MAJCOMS may require exceptions from the assigned determination because the capability exists in another organization. Requests to deviate from the assigned calibration responsibility shall be processed through the MAJCOM PMEL Functional Area Manager (FAM). If the FAM accepts the request, the request along with supporting comments shall be forwarded to AFMETCAL Det 1 for review. AFMETCAL's concurrence or non-concurrence shall be forwarded to the FAM. If AFMETCAL Det 1concurs, the FAM may authorize the PMEL to change their local -100 via message or letter. PMEL shall retain the authorization and make it available upon request.

3.1.6 Calibration Equipment Traceability/Accuracy. The overall program shall be designed and operated to ensure measurements are traceable through the AFPSL to NIST or other AFMETCAL Det 1 approved sources. The equipment required to calibrate TMDE is listed in each calibration T.O. Other equipment, which has the necessary functions, ranges, and accuracies, may be substituted to perform the calibration even though they may not have all the characteristics of the listed item. Use T.O. 33K-1-101-CD-1 to assist in the identification of substitute items. If the accuracy ratio of the equipment specified in the T.O. is better than 4 to 1, substitute equipment shall not lower this accuracy ratio to less than 4 to 1. If the ratio of accuracies is less than 4 to 1, equipment substituted shall have accuracy equal to or better than the equipment specified. EXAMPLE: If the accuracy of the specified equipment is only 2 to 1, the accuracy of the substituted standard must be at least 2 to 1. CAUTION: Care must be taken in determining the accuracy of a given measurement. In many instances, the accuracy of the measurement is not the sum of accuracies of the instruments used. Modification of procedural steps is authorized when substitute equipment is used. However, all parameters, ranges, and accuracies in Table 1 of the calibration T. O. shall be met or exceeded. Questions regarding determination of accuracies shall be directed to the responsible engineer at AFMETCAL Det 1. (If you have access to the AFMETCAL PMEL internet site 'METWEB', see the AFMETCAL POC page). Air Force calibration procedures (33K series technical orders) are designed to ensure calibrations are traceable through the AFPSL to NIST or other AFMETCAL DET 1 approved sources. Air Force calibration laboratories (both PMELs and the AFPSL) shall ensure that any substitution of equipment and subsequent modification of procedural steps does not adversely affect the traceability of the calibration being performed.

3.1.6.1 Calibration Software. When using calibration software, the calibration authority for the measurement shall be established using the order of precedence noted in Paragraph 3.1.2. Normally, the calibration authority is a 33K Series calibration procedure. The calibration authority is cited on the calibration certificate/label. Thus, the calibration of the end item shall satisfy the requirements contained in the calibration authority. Use of calibration software is viewed as a controlled substitution of equipment. The control is established through the documentation and validation and verification requirements noted in Table 3-1. Use of software that has not been properly documented, validated, and verified is prohibited and is grounds for audit failure by either the local PQA evaluator or by the visiting AFMETCAL Det 1 certification team. Calibration software is divided into four classes as shown in Table 3-1.

3.1.6.2

Table 3-1
CALIBRATION SOFTWARE CLASSES

SW Class	Developer	Maintainer	Distributor	Val & Ver	Calibration Authority	Documentation
AFMETCAL CPIN	AFMETCAL	AFMETCAL	AFMETCAL	AFMETCAL	See para 3.1.2	AFMETCAL Generated & Approved
PMEL/ AFPSL CPIN	PMEL/ AFPSL	AFMETCAL	AFMETCAL	PMEL/ AFPSL/ AFMETCAL	See para 3.1.2	PMEL/ AFPSL Generated - AFMETCAL Approved
PMEL/ AFPSL Local	PMEL/ AFPSL	PMEL/ AFPSL	Not Authorized.	PMEL/ AFPSL	See para 3.1.2	PMEL/ AFPSL Generated - PQA Approved - Copy of Val & Ver doc shall be kept on file - Notify AFMETCAL of usage
Commercial	Commercial	Acquirer	Acquirer	Acquirer	See para 3.1.2	Acquirer Responsibility - Copy of Val & Ver documentation shall be kept on file - Notify AFMETCAL of usage

3.1.6.2.1 Definitions for Table:

a. Developer: Authors software.

b. Maintainer: Maintains software and is responsible for configuration control and software changes/updates. The Maintainer shall keep the calibration software in agreement with the Calibration Authority.

c. Distributor: Distributes software to users. Updated copies of the calibration software shall be provided whenever the Maintainer accomplishes changes/updates.

d. Validation & Verification: Organization responsible to validate and verify that software satisfies calibration requirements. Validation and verification shall demonstrate and document that the software operates correctly, produces the desired result, cannot be manipulated/changed during operation, and satisfies and is equivalent to the Calibration Authority.

e. Calibration Authority: Calibration requirements as determined by AFMETCAL Det 1 shall be established using the order of precedence noted in Paragraph 3.1.2.

f. Acquirer: Organization that procures the calibration software.

3.1.6.2.2 Calibration software documentation levels shall be determined by the Maintainer, but shall include as a minimum:

a. End items to be calibrated with the software.

b. Software identification number.

c. Software revision status/number.

d. Calibration authority to be cited (including version date).

e. Software Validation and Verification (Val & Ver) Plan.

f. Validation and Verification results. This documentation shall be maintained throughout the software's life.

NOTE

Software Validation and Verification shall be re-accomplished and documentation updated if the Calibration Authority is changed and/or updated. Calibration software that has not undergone Validation and Verification against the published (official) version of the Calibration Authority or lacking current up to date documentation cannot be used.

3.1.6.2.3 Additionally, the methods used to acquire, develop, maintain, validate and verify, distribute, document and control calibration software shall be addressed in the laboratory's Quality Manual. Copies of the software documentation and the laboratory quality manual shall be available for review by AFMETCAL Det 1 upon request. Upon review, AFMETCAL Det 1 reserves the right to disapprove usage of the software, if it has not been

adequately validated and verified, does not have current up to date documentation, does not satisfy or is not equivalent to the Calibration Authority.

3.1.7 Calibration Procedures. AFMETCAL Det 1 shall prepare, maintain, and control content, and issue 33K series technical orders and software for calibrating measurement standards, TMDE, and automated test equipment defined as the responsibility of the PMEL. AFMETCAL Det 1 shall publish and maintain T.O. 33K-1-100-1, Technical Manual TMDE Interval, Calibration, and Repair Technical Order Reference Guide and Work Unit Code Manual. AFMETCAL Det 1 shall ensure:

a. Calibration procedures contain the required range and tolerance or uncertainty of each item or unit parameter being calibrated or verified.

b. The procedures contain a generic description of the measurement standards and equipment needed with the required parameter, range, tolerances or uncertainties, and specifications for performing the measurement, and/or representative types (manufacturer, model, option) that are capable of meeting the generic description for the measurement standards.

c. The procedures are consistent with the accuracy required, and with any standard specifications relevant to the calibrations/verifications concerned.

d. The calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected. Well-defined and documented measurement assurance techniques or uncertainty analyses may be used to verify the adequacy of a measurement process. If such techniques or analyses are not used, then the collective uncertainty of the measurement standards shall not exceed 25 percent (4:1) of the acceptable tolerance for each characteristic of the measuring and test equipment being calibrated or verified.

3.1.7.1 Locally Developed Procedures. Locally developed procedures shall not be used to perform calibration until approved by AFMETCAL Det 1 and the using command (Ref T.O. 00-5-1). Format of the procedures shall conform to MIL-PRF-38793B and MIL-STD-38784. The writing shall conform to the plain English standards and minimum editorial requirements listed in AFI 37-360V2. The local procedures shall be routed through the PMEL's FAM to AFMETCAL Det 1.

3.1.7.2 Procedure Specifications. 33K Series calibration procedures shall be written to meet manufacturer's specifications whenever possible. The procedure shall direct use of a Limited Certification Label if the parameters listed in Table 1 of the calibration procedure do not meet the manufacturer's specifications. This is to ensure the user of the TMDE is made aware of the deviations from manufacturer's specifications. Table 1 specifications of 33K Series T. O. take precedence over other specifications or tolerances listed throughout the T.O.. Individuals discovering contradictions between Table 1 and any other section of the T.O. shall comply with paragraph 3.1.8.

3.1.7.3 T.O. Verification Process**.** Laboratories shall perform T.O. verification on all new draft calibration procedures received from AFMETCAL Det 1 for review. Guidelines detailing the verification process are outlined in Director's Guidance Memorandum "Verification of Calibration Technical Order (TO)."

3.1.7.4 Post-Publication Reviews: AFMETCAL Det 1 will perform Post-Publication Reviews on formal T.O. under the following conditions:

a. The T.O. has not been changed for five years.

b. The recommendation of the Technical Content Manager (TCM).

c. The recommendation of the T.O. Manager due to the number of AFTO 22s received. At the request of the using command Functional Area Manager.

During a Post Publication Review, one or several PMELs may be tasked to participate, either locally or at another site. This tasking shall be at the discretion of the TCM. Reference AFMCI 21-301, T.O. 00-5-1, and T.O. 00-5-3.

3.1.8 Documenting and Reporting Procedure Problems. PMEL technicians experiencing difficulty performing calibration procedures shall contact the appropriate AFMETCAL Det 1 branch for assistance or submit an AFTO Form 22 as necessary. When a calibration procedure (33K) contains an error and an AFTO Form 22 is submitted, the technician shall select an alternate procedure for the affected parameter(s) in compliance with paragraph 3.1.2, and document the calibration authority for the affected parameter(s) in the Special block of the certification label.

3.2 EXCEPTIONS FROM PERIODIC CALIBRATION. Some types of TMDE do not require periodic calibration. They include items not used to make quantitative measurements, TMDE seldom used but must be calibrated before use, items designated as not requiring calibration, and TMDE that requires initial calibration only.

3.2.1 No Calibration Required (NCR) Items. Certain types of TMDE identified as NCR do not require calibration because they do not provide important quantitative measurement information, and/or are accessories to other TMDE

or function only as an interface device. Examples are RF receivers traceable to a frequency standard; some automotive test equipment; some pressure regulators, isolators, terminations, loads, adapters, tees, circulators and waveguide components. Exception may occur when such items present an actual workload for the PMEL. Examples: NCR items may require calibration in specific applications, or the user may request calibration of an NCR item. The user shall supply justification for the need. Bar code labels shall not be applied on customer owned NCR items that cannot be repaired unless the item requires periodic calibration by the PMEL. An AFTO Form 256, *No Calibration Required*, label or a 'white dot' shall be affixed in accordance with Section 5.

3.2.2 Calibrate Before Use (CBU). There are two criteria for CBU:

a. TMDE identified by AFMETCAL Det 1 as CBU in a CMS or T.O. 33K-1-100-2. These items require calibration or operational verification prior to every use rather than periodical calibration. Generally, the CMS or T.O. 33K-1-100-2 entry for CBU items will reference a specific 'Note Code' instruction in T.O. 33K-1-100-1 Section 3.

b. TMDE that normally is not used at least once during its calibration interval need not be periodically calibrated and may be designated as CBU. Calibration of TMDE designated CBU need not be recalibrated until the TMDE is to be used even though the calibration due date has passed. CBU items shall be calibrated at least once before being designated as CBU. New TMDE shall require an initial calibration to ensure it meets requirements before being designated CBU. Previously calibrated TMDE shall not require a recalibration before being designated CBU unless requested by the user. After notifying the PMEL to update the master inventory, the user may enter "/CBU" following the DATE DUE date on the Certification Label and hold the item until they require it to be calibrated. After calibration of a CBU designated item, an AFTO Form 99 or 398, whichever is applicable, shall be completed and marked CBU in accordance with Section 5. The CBU designation shall be entered in the PMEL Master Inventory listing in place of the frequency.

NOTE

PMEL cannot make an item CBU without the user's direction or permission.

3.2.3 No End-Item Calibration (NEC). NEC in the calibration interval denotes TMDE designated SICL (See Individual Component Listing) in a CMS or T.O. 33K-1-100-2, that does not have an end-item-calibration requirement. NEC only applies to the end-item; not subcomponents listed with separate calibration intervals.

NOTE

For scheduling systems that have not been updated to process NEC, load as NCR.

3.2.4 Next Higher Assembly (NHA). NHA in the calibration interval field of a CMS or T.O. 33K-1-100-2 denotes subcomponents that are calibrated as part of a next higher assembly. The calibration interval and calibration T.O. of the next higher assembly apply unless otherwise noted. NHA items shall not generate a separate "due calibration" in addition to the end item. The next higher assembly calibration sticker applies to all subcomponents designated NHA.

NOTE

For scheduling systems that have not been updated to process NHA, load as NPC so only the next higher assembly is scheduled for calibration.

3.2.5 No Periodic Calibration Required (NPC) Items. There are two criteria for NPC:

a. TMDE which are subcomponents of a higher assembly that are identified by AFMETCAL Det 1 as NPC in a CMS or T.O. 33K-1-100-2 do not require periodic calibration. These items shall require an initial calibration to ensure it meets requirements of the applicable calibration authority. This TMDE shall require calibration after repair is accomplished. An AFTO Form 99 or 398 shall be completed and affixed to the TMDE. TMDE designated NPC shall be identified in the PMEL Master Inventory Listing as NPC where the frequency is normally entered.

b. Based on user applications (see below), an individual unit of TMDE may not require periodic calibration. Even though it belongs to a part number group that normally requires calibration per a CMS or T.O. 33K-1-100-2, it may be locally designated as NPC by the user. The TMDE user exercises the option of designating an item NPC by contacting the PMEL with the request that a specific item be made NPC for one of the reasons listed below. This TMDE shall require an initial calibration to ensure it meets requirements of the applicable calibration authority. The unit shall not require another calibration if the

user wants to designate the item NPC at a later date. This TMDE shall require calibration after repair is accomplished. AFTO Form 99 or 398 shall be completed and affixed to the TMDE. TMDE designated as NPC shall be identified in the PMEL Master Inventory Listing as NPC where the frequency is normally entered. The TMDE user may designate an item NPC if either:

(1) Its performance is verified, checked, or monitored by other certified TMDE.

(2) It does not affect safety and is not used to verify equipment performance factors or make absolute measurements.

NOTE

PMEL cannot make an item NPC without the user's direction or permission.

3.2.6 Training Equipment. TMDE used solely for training and not used to verify specifications or performance factors of operational weapon/support systems or does not affect safety may be identified as NPC. Calibration shall be performed if management determines it is required for contingency purposes. Calibration after repair of TMDE used for training and designated NPC is optional based on agreement between user and the PMEL flight chief. Instructors shall remove, or annotate malfunctions implanted for training purposes prior to processing any TMDE for repair or calibration. Instructors shall ensure TMDE coded NPC with inoperative functions or ranges is processed for repair before the item becomes totally inoperative. TMDE requiring calibration shall use the interval specified in the applicable CMS, if appropriate or T.O. 33K-1-100-2. TMDE used for training and identified as NPC shall have an AFTO Form 99 or 398 attached. The Standard Reporting Designator (SRD) for resident training TMDE is "HTE". All other TMDE shall use normal SRD reporting codes.

3.2.7 Initial Calibration Only (ICO). Due to its inherent design features, TMDE designated ICO does not require periodic calibration. This TMDE shall be calibrated when initially entering service, or if necessary to meet required specifications after repair. An exception is an absolute standard, which does not require any calibration. Retain report of measurement or certificate of calibration from NIST, AFPSL, PMEL (when PMEL has measurement capability) or original equipment manufacturer (OEM) on file in the PMEL until the TMDE is no longer needed. A properly completed certification label and supporting data is sufficient for ICO items certified by the PMEL. The ICO category also includes certified reference materials or samples which might be obtained from NIST or other sources.

3.2.8 Depot or Base Supply Stocks. Except for the following situations, items in depot or base supply stocks do not require periodic calibration. Items of TMDE that are an integral part of an automatic test station and are maintained as spares in a forward supply point shall be calibrated prior to turn-in to supply and thereafter at their designated calibration interval unless another interval is prescribed in the applicable weapon CMS. The items shall be tested in the station if possible.

3.3 LIMITED OR SPECIAL CALIBRATION. A Limited or Special calibration requires the use of an AFTO Form 99 or 398 Limited TMDE Certification label. The authorization for a limited or special calibration shall be documented in the USER APPROVAL block of the AFTO Form 99 or in the INI block of the AFTO Form 398 in accordance with Section 5.

3.3.1 Limited. There are several situations where the PMEL may be authorized to perform a limited calibration.

3.3.1.1 T.O. Directed Limited Calibration. Limitation can be identified in the calibration procedure. The procedure can contain a statement such as "The Test Instrument accuracy has been downgraded from the manufacturer's specifications due to a lack of adequate standards" and direct use of the limited calibration certificate.

3.3.1.2 Limited PMEL Capability. When a PMEL does not have the capability to calibrate the full range of specifications contained in the calibration procedure or maintenance T.O., the PMEL supervisor shall advise the using activity of the extent of services available. The using activity shall decide if the available service meets the mission requirements. If the limited calibration service does not meet their needs, the using activities shall advise the PMEL, and action shall be taken in accordance with paragraph 4.1.

3.3.1.3 Limited User Requirement. When a user requires less than the full capability of the TMDE, the user shall specify the desired calibration points or ranges to the PMEL. The PMEL shall clearly identify the certified points or ranges (or the limitations) on the instrument's certification label (AFTO Form 99 or AFTO Form 398 or the form that accompanies them).

3.3.1.4 Instrument Limitation. When a function, range, or specification on a multi-function instrument cannot be economically restored to original design specifications, the PMEL supervisor shall advise the using activity of the

condition. The user shall then decide if the missing function is necessary to support the mission or if a replacement item is needed. If a limited calibration can permit proper mission support, the PMEL can perform the limited calibration. If not, the item shall be returned to the user, with the appropriate condition tag affixed in compliance with T.O. 00-20-3.

3.3.1.5 AFPSL Limitation. If the AFPSL cannot perform a complete calibration because the capability does not exist to calibrate the item to full manufacturer's specifications, the AFPSL may perform a limited calibration. Document all such limitations on an AFTO Form 99. The limitation shall be identified (documented) in the procedure.

3.3.2 Special. When a special calibration is performed, the ability of the test instrument to maintain accuracy through the calibration interval is questionable and the user shall be notified of the inherent risk. A typical special calibration includes an extra data point(s) such as a special frequency or reading that is not in the calibration procedure. They may also be:

a. Calibration of an item designated as NCR.

b. Calibration of a unit to a higher accuracy than specified in the calibration procedure. In this case, the unit must be capable of providing the higher accuracy within manufacturer's specifications. Whenever possible, performance specifications shall be consistent with the manufacturer's specifications (MIL-PRF-38793B, paragraph 3.2.2.2). If they are not, the calibration procedure shall identify any deviations from manufacturer's specifications.

c. Calibration of an item that has no identifiable manufacturer or part number. In this case the user shall submit, in writing, a special calibration request that includes range and accuracy required and a documented reference (T.O., Test Program Set, test plan, etc.). Laboratory personnel shall determine if the test instrument is capable of supporting the required measurement. If there is reasonable doubt of Test Instrument capability, the item shall not be calibrated. When calibrated, the Test Accuracy Ratio shall be at least 4:1. The certified accuracy must not exceed the Table 1 specifications of the general calibration procedure used as per T.O. 33K-1-100-1. The certified accuracy shall be annotated on the certification label.

3.3.2.1 PMEL Special Calibration. The PMEL shall contact AFMETCAL Det 1 for direction when there is a 33K-series calibration procedure written with uncertainties downgraded from the manufacturers stated uncertainties and there is a need to certify TMDE to the manufacturer specifications.

3.3.2.2 AFPSL Extended Calibration. To meet Air Force requirements, the AFPSL may perform special calibrations that exceed manufacturer's ranges and/or specifications. In such cases, specific details of the extended calibration shall be documented and published in the calibration procedure if the extended calibration is an ongoing occurrence. An AFTO Form 108 shall be used by the AFPSL in these instances. An AFTO Form 99 shall be used if it also has a limited parameter. An uncertainty analysis shall be performed and documented to substantiate the uncertainties published.

3.4 CALIBRATION INTERVALS. The Air Force calibration interval (calibration cycle) listed in a CMS or T.O. 33K-1-100-2 is the period of time over which the equipment shall perform its mission (or function) with a statistically derived end-of-period reliability (shall be within tolerance) of 85% or better. These intervals are established, and modified as necessary, from data collected through the maintenance data collection system on the total TMDE population. TMDE that has exceeded the prescribed calibration interval shall not be used. However, the date due can be extended in certain cases. Paragraphs 3.4.10 through 3.4.15 identify those cases.

3.4.1 Precedence for Calibration Intervals. Calibration interval selection shall be made in accordance with the following precedence:

a. CMS (Applicable to TMDE used solely to support a system referenced in the CMS). TMDE applicable to more than one CMS shall be calibrated to meet all CMS requirement and noted as such in the SPECIAL block of the certification label.

b. T.O. 33K-1-100-2.

c. General procedure interval listed in T.O. 33K-1-100-1 Section 3-1, if applicable.

d. Individual maintenance T.O.s.

e. Commercial data.

3.4.2 Intervals for New Items and Items Listed without a Calibration Interval. The maximum calibration interval for TMDE is 12 months when an interval is not prescribed by a T.O..

3.4.3 Published Calibration Interval Changes. It is not mandatory that TMDE be rescheduled or recalled for calibration or update of certification solely because a change to a calibration interval is published. Items changed from NCR, ICO, or CBU to a periodic calibration interval shall be removed from service and recalled to the PMEL and calibrated. When large quantities are involved, the recall should be staggered to maintain an even flow of workload into the PMEL.

3.4.4 Other Reasons for Calibration Interval Changes. TMDE users may request recalibration of their TMDE any time there is reason to question the accuracy of the instrument. Items exposed to rough handling, overload, or other severe conditions shall be removed from service and recalibrated regardless of the calibration due date. TMDE users may request shorter calibration intervals to meet mission requirements. Users may also request special calibration of NCR items if they are used to accept or reject items. PMEL may shorten a calibration interval based on calibration mobility team schedules, PMEL workload, or excessive unscheduled maintenance.

3.4.5 Recommending Changes to Calibration Intervals. Air Force activities that have accumulated data to substantiate a change in calibration intervals may submit this data and the recommended changes to AFMETCAL Det 1. Interval changes must be approved by AFMETCAL Det 1.

3.4.6 War Reserve Material (WRM) TMDE Calibration Intervals. A WRM kit package or container shall be labeled with a calibration due date equal to 18 months from the earliest date calibrated item packed in accordance with Section 5. TMDE to be placed in WRM kits shall be calibrated prior to packaging. Calibration intervals for TMDE in WRM kits do not start until they are unpacked for use. Once removed from the package, all items shall revert to their normal interval. TMDE that is not removed from the package and whose accuracy is not in question need not be calibrated until the 18-month period marked on the package has expired. Any obvious damage to the equipment package would be cause to recalibrate the TMDE. Due to the many unforeseen circumstances that could arise from storing equipment in relatively uncontrolled areas, 18 months has been determined as the maximum time WRM equipment could be stored with a reasonable expectation that the equipment will operate within the specifications of the calibration procedure. In lieu of storing TMDE in WRM kits, TMDE may be individually tagged and placed in a stringently controlled, limited-access area(s). When an item of TMDE is removed from this controlled area, calibration interval reverts to the interval specified in the CMS or T.O. 33K-1-100-2. The following paragraph identifies items that cannot be stored in WRM kits, or require special precautions.

3.4.6.1 Items that either can't be stored in WRM kits or require special precautions:

a. GAS DETECTORS CONTAINING SENSORS WITH A SHORT SERVICE LIFE – Ensure the Sensor service life covers the maximum possible projected storage period.

b. RADIAC DOSIMETERS - Those that need to be recharged periodically (usually 30 days) shall not be placed in long time storage.

c. STANDARD CELLS - A period of weeks is required to obtain accurate voltage readings.

d. CESIUM BEAM FREQUENCY STANDARD - Cesium Beam Tube would be ruined if it were turned off more than 90 days. The ion pump could not keep the tube evacuated.

e. NI-CAD BATTERIES - Shall require recharging after 18 months in storage.

f. TEMPERATURE BATH - Drain oil before storing.

g. DEADWEIGHT TESTER - Drain oil before storing.

h. VACUUM SYSTEM - Drain oil before storing.

i. HYDRAULIC FORCE PRESS - Drain oil before storing.

j. HOOK GA GE - Drain water before storing.

k. PNEUMATIC PRESSURE STANDARDS AND LO PRESS GAGES - Require dry nitrogen source to use.

l. ALKALINE BATERIES - Remove from equipment prior to storage.

3.4.7 Special Purpose Recoverable Authorized Maintenance Set (SPRAMS). Spare Tester Replaceable Units (TRUs) stored in SPRAMS require a DD Form 1574 Serviceable Label and an AFTO Form 99/108/394/398 Certification Label attached in accordance with Section 5. For scheduling purposes, the calibration interval of TRUs in SPRAMS shall be 18 months. TRUs to be placed in SPRAMS shall be calibrated prior to being stored. Calibration intervals for TMDE in SPRAMS do not start until they are removed from storage. Once removed from storage, the TRU shall revert to the normal interval. SPRAMS assets that are calibrated as part of an end-item (i.e., a system calibration) that are NOT installed back into the same end-item they were originally calibrated in, shall be re-calibrated at the time of installation to establish system integrity.

3.4.8 Foreign Military Sales (FMS) TMDE Interval Adjustments. FMS TMDE calibration dates may be adjusted in the following manners:

a. AFMETCAL Det 1 may delay the start of (post date) calibration intervals for FMS items (except for those items specified by Metrology engineers) being assembled to meet foreign country PMEL activation dates to agree with the activation date or other milestones.

b. FMS customers may adjust calibration intervals if shipping time to country is in excess of fifteen days. The following rules apply:

(1) Receipt in-country must be recorded and filed.

(2) The number of shipping days consumed will advance calibration Due Dates when:

- Interval is equal to or less than 90 days. May be adjusted up to 45 days.
- Interval is more than 90 days. May be adjusted up to 60 days.
- No interval may be adjusted by more than 60 days.

3.4.9 Coding of TMDE Subject to Deployment. TMDE that is subject to deployment shall be identified as Mobility, Deployed, or WRM on the master inventory. This shall be accomplished by entering the code in the ON-MOBILITY field of the PMEL Automated Management System scheduling screen. The PAMS Mobility Field Codes are contained in T.O. 33K-1-100-1, Section 2.

3.4.10 Exchange Standard Intervals. The calibration interval for Exchange Standards sent to PMEL in exchange for base measurement standards due for certification may be up to 60 days longer than the calibration interval listed in T.O. 33K-1-100-2 to account for administrative and transit time. The date calibrated on Exchange Standards shall reflect the actual date of calibration. The date due shall be established as the 28th day of the month in which the item is due for recertification. These dates shall not be changed by the PMEL.

3.4.11 AFPSL Equipment Due Date Extensions. AFMETCAL Det 1 is responsible for authorizing the extension of calibration due dates of Air Force Measurement Standards used by the AFPSL.

3.4.12 Test Project TMDE Due Date Extensions (excluding RADIAC equipment). Test project TMDE that is assigned a periodic calibration interval may have its due date extended by mutual agreement between the test director and the PMEL Manager, if calibration of the TMDE would adversely affect a test. The due date may be extended to the end of the test or an additional 50 percent of the assigned interval, whichever is less. The test director must verify that the extension is at their request, and the PMEL is no longer responsible for the accuracy of the TMDE in the test setup.

3.4.13 Critical TMDE Due Date Extensions (excluding RADIAC equipment). MAJCOMs are authorized to extend the calibration due date if the loss of the TMDE will delay or prevent critical mission accomplishment. Requests for extensions shall be forwarded to the command PMEL Functional Area Manager (FAM). The request shall describe the TMDE involved, the calibration due date, the specific reasons calibration cannot be accomplished as scheduled, the estimated date calibration action can be initiated, actions taken to locate a suitable alternative or substitute item, and the calibration history of the TMDE. Also include a statement from the OWC Maintenance Superintendent indicating the understanding that calibration intervals are the period of time over which TMDE maintain a statistically derived end-of-period reliability of 85% or better and that extending the interval will jeopardize TMDE accuracy reliability.

3.4.14 Base Measurement Standard Due Date Extension. The command PMEL Functional Area Manager (FAM) is authorized to extend the calibration due date of Base Measurement Standards provided by AFMETCAL Det 1 to the PMELs. Information copies of extensions shall be sent to AFMETCAL Det 1. This authorization does not apply to Exchange Standards.

3.4.15 On-Site Off-Base TMDE Due Date Extensions. The PMEL Manager is authorized to extend the calibration due date up to ten days for off-base TMDE calibrated on-site to facilitate scheduling.

3.4.16 Return Transportation Time and TFCU Visit Due Date Adjustment. PMEL Managers have the authority to adjust calibration due dates up to one month to offset return transportation time or scheduled TFCU visits. This is not blanket authority to extend all items in the inventory, but shall be used only on a case-by-case basis.

3.5 PRECISE TIME SUPPORT. Precise time support is now accomplished using the GPS system through the local PMEL. Repair and replacement actions for cesium standards used for frequency or time standard should be accomplished through the appropriate item manager at WR-ALC.

3.5.1

3.6 TMDE USER RESPONSIBILITIES. The user shall:

a. Appoint a TMDE coordinator. A TMDE coordinator is not required at locations where the PMEL supports only one organization. The TMDE coordinator shall attend training and maintain a TMDE coordinator file that includes:

(1) Name of primary TMDE coordinator and alternate.

(2) OWC Master ID Listing. Not required in the PMELs TMDE coordinator file.

(3) OWC Master Equipment Schedule.

(4) Test equipment hand receipts from PMEL. Not required in the PMELs TMDE coordinator file.

(5) A copy of the base instruction, if applicable. Not required in the PMELs TMDE coordinator file.

(6) Any customer handout(s) that might be provided by PMEL. Not required in the PMELs TMDE coordinator file.

NOTE

Customers (at least the coordinators) shall have access to and be familiar with contents of T.O. 33K-1-100-1, T.O. 33K-1-100-2, T.O. 00-20-14, any applicable CMS T.O.s, T.O. 00-25-234, T.O. 33-1-27 and T.O. 33-1-32. Preferably, coordinators of large accounts shall maintain their own copy of these T.O.s.

b. Calibrate, certify, and repair TMDE specified in any applicable CMS T.O.s or T.O. 33K-1-100-2 as a USER responsibility. If they do not have the capability, obtain calibration and maintenance support from the lowest echelon organization having the capability. If no other organization has the capability, the PMEL shall assist by providing training, workspace, technical assistance, or support, as required.

c. Request approval from AFMETCAL Det 1 prior to obtaining calibration of Air Force TMDE from commercial sources (see Section 4).

d. Accomplish and use applicable forms, labels, and alternate methods of certification IAW Section 5 of this T.O.

e. Return all TMDE specified as PMEL() or AFPSL responsibility in any applicable CMS T.O.s or T.O. 33K-1-100-2 to the PMEL when scheduled for calibration or for unscheduled maintenance. Identify TMDE not listed in any applicable CMS T.O.s or T.O. 33K-1-100-2 to the PMEL for calibration determination action. Commanders and supervisors of all activities owning and using TMDE requiring calibration are responsible to ensure this TMDE is not used unless it has been calibrated and that it is removed from service once the calibration due date has expired. Exception to this statement only as covered by paragraphs 3.4.10 through 3.4.15.

f. Consider alternative of limited calibration, CBU, or NPC status, where possible.

g. Deliver TMDE to the PMEL with all ancillary equipment (e.g., preamps, power supplies, adapters, cables, or probes) needed for the calibration. PMEL personnel shall advise the user when an item is not sufficiently complete to allow full calibration and may return the item without action if the ancillary equipment and/or technical data are not readily available.

h. Provide proper care, handling, cleanliness, and transportation of TMDE (see paragraph 3.8).

i. Ensure that notes contained in the SPECIAL block of the certification labels are read and understood.

j. Refer measurement standards authorized for use by activities other than the PMEL to the base PMEL for calibration. The base PMEL shall either calibrate these items or request assistance in accordance with paragraph 4.1. Measurement standards owned by research and development laboratories and used to support measurement areas peculiar to a specific PMEL may be used to calibrate TMDE that cannot be supported by the PMEL. The PMEL is responsible for ensuring these standards meet certification requirements.

k. Maintain technical data file for equipment owned. Provide technical data with the TMDE when requested by the PMEL. The TMDE User shall ensure adequate maintenance and technical data for each item of TMDE are available and that the technical data accompany their TMDE whenever they are deployed.

l. Request assistance from the base PMEL for calibration of individual items of TMDE that require equipment and technical skills normally in the PMEL. Also request PMEL help when specified in the applicable weapon system or equipment CMS T.O. Ensure that TMDE used as component parts of systems or subsystems (e.g., B-52, AN/FPS-27, etc.) are not removed for calibration unless the system, subsystem, maintenance, or CMS T.O. requires it.

m. Identify and/or coordinate any requirements for limited or special calibrations with the base PMEL. Comply with procedures for exceptions from periodic calibration as specified in paragraph 3.2. Place authorizing signature or initials on AFTO Form 99 or AFTO Form 398 in accordance with Section 5. This is to be done for TMDE that has received limited or special calibration when returned from the PMEL, or for TMDE that is to be exempted from periodic calibration.

n. Request calibration assistance as outlined in paragraph 4.1 when assistance is required.

o. Perform organizational maintenance on assigned TMDE in accordance with T.O. 33-1-27. This responsibility applies to stock listed and nonstock listed TMDE in all federal supply classes.

p. Remove AFTO Forms (108, 394, 99, or 398) from units being returned to supply stocks and notify PMEL of the turn-in. AFTO Forms 108, 394, 99, or 398 on items withdrawn from supply are invalid except for those on Redistribution Order actions. AFTO forms 65 and 66 stay on equipment.

q. Leave all condition tags and other documentation including warranty tags (except the receipt) on TMDE being forwarded to the PMEL for initial calibration or acceptance testing and retain shipping containers. The initial calibration is a serviceability check on items from a vendor, technical repair center, or other base. Discrepancies found by the PMEL during initial calibration shall be reported to the users so they can submit deficiency reports back to the source of supply. A calibration procedure can serve as a guideline for an acceptance check.

r. Provide adequate facilities for TFCU or other PMEL mobile calibration operations.

s. Ensure that torque-indicating devices, specified as PMEL responsibility in T.O. 33K-1-100-1/-2 or any applicable CMS T.O., are sent to the PMEL for scheduled calibration or unscheduled maintenance. Torque indicating devices are considered TMDE and PMELs are assigned the primary responsibility for calibration and repair. If not collocated on an installation with a PMEL, User organizations, through their PMEL MAJCOM FAM, may request authorization from AFMETCAL Det 1 to support their own torque devices. AFMETCAL Det 1 will review the request and render a decision. Approved User Torque Calibration and Repair Sites will be listed in Section 10. The requesting organization shall comply with the following requirements to receive an authorization:

(1) Ensure torque devices are calibrated per any applicable weapon system Calibration and Measurement Summary (CMS) or T.O. 33K-1-100-1/-2.

(2) Ensure torque devices NOT covered by the exemption, and NOT owned by the organization are sent to an AFMETCAL Program PMEL for calibration and repair support.

(3) Ensure all personnel that perform torque calibration and repair are properly trained.

(4) Ensure only AFMETCAL Det 1 approved calibration standards are used, that they are properly maintained, and that they are calibrated by an AFMETCAL Program PMEL.

(5) Collect and report maintenance data to AFMETCAL Det 1, as requested.

(6) Participate in AFMETCAL Det 1 proficiency testing, as required.

(7) Implement a quality program, and participate (as required) in the AFMETCAL Det 1 evaluation program.

(8) Report the inventory of torque devices supported to AFMETCAL Det 1, as requested.

(9) Submit a completed torque calibration site worksheet with authorization request.

(10) Ensure a bar code label, AFTO Form 65 or 66, is affixed to each item in inventory.

t. Return special weapons test equipment designated as PMEL responsibility to the base PMEL for calibration and repair. The PMEL has the responsibility to repair and calibrate Air Force and Nuclear Regulatory Commission (NRC) designated nuclear ordinance commodity managed test equipment. This is meant to include all test equipment that contains radioactive material.

u. Ensure that medical equipment is referred to the appropriate support activity in accordance with AFMAN 23-110CD and T.O. 33K-1-100-1. TMDE locally purchased by the hospital requiring PMEL support shall be coordinated with the PMEL prior to purchase to ensure supportability.

v. Ensure that Skydrol fluid pressure gages are calibrated using a Skydrol fluid pressure standard. The gage user is responsible for calibrating these gages.

w. Ensure users do not reset adjustments/potentiometers that are sealed with an AFTO Form 255. "NOTICE CERTIFICATION VOID WHEN SEAL IS BROKEN." Any unit discovered with a broken AFTO Form 255 shall be removed from service and submitted for recalibration.

x. Ensure that components of complex TMDE (test stands, checkout consoles, etc.) are not removed for calibration merely because the components are listed individually in T.O. 33K-1-100-2. Removal of these components for calibration shall be accomplished only as specified in the calibration authority. Complex TMDE components that require calibration shall be calibrated in place, if feasible. Components that require calibration by the PMEL shall be calibrated in accordance with the provisions of a CMS or T.O. 33K-1-100-2. Typical items are pressure gages, panel meters, power supplies, frequency meters, etc. To preclude excessive down time, each component shall be calibrated at the shortest interval listed for any of the components, or at a multiple of the shortest interval, if this multiple does not exceed its own listed interval. For example, if the shortest interval is 120 days, an item with a 270 day interval may be checked every 120 days or it may be shortened to 240 days and checked every other time.

y. Prior to the 'local purchase' of TMDE:

(1) Coordinate with PMEL to verify there is no existing TMDE that can be used to satisfy the requirement as soon as a part number or model number is available.

(2) Coordinate with PMEL to determine if the item is already listed in a CMS or T.O. 33K-1-100-2. Perform action in next paragraph if it is not listed.

(3) Assist PMEL in completing the Request for Calibration Responsibility Determination per Section 5 and provide the necessary commercial data.

(4) Provide funding for resources needed to support locally procured TMDE. This includes funding for repair and calibration when locally procured TMDE is beyond the support of the local PMEL.

(5) Process deficiency reporting to source of supply when locally procured TMDE fails initial calibration or acceptance testing.

(6) Follow the guidance in AFI 64-117, AF Government –Wide Purchase Card Program, when using a Government Purchase Card to local purchase TMDE.

z. Provide PMEL with mission impact statements for AWP follow-ups.

aa. Perform all periodic maintenance or inspections as directed by maintenance T.O.s.

bb. Notify PMEL of the date items are removed from WRM packages and placed into use. Complete the date due block of the certification label. PMEL may be contacted for assistance in calculating the date due. Date due shall be dependent upon calibration interval stated in the T.O. 33K-1-100-2 or applicable CMS.

cc. Ensure all forms, labels, and calibration correction charts received with the TMDE from the PMEL are complete. Notify the supporting PMEL of errors encountered.

dd. Identify all TMDE that is designated as WRM or subject to deployment. This information shall be provided to servicing PMEL to be included on master inventory.

ee. Provide PMEL information regarding the use made of RADIAC equipment to permit PMEL to determine calibration interval. To be precise, is it NDI equipment, disaster preparedness, or medical equipment?

ff. Remove batteries from FSC 6665 RADIAC equipment being sent to a PMEL that does not affect the calibration of the unit.

gg. Maintain warranty information on all TMDE and document start and stop dates and other warranty conditions.

3.7 INPUT PRIORITY SYSTEM. Items submitted to a PMEL or the AFPSL shall use the following priority system based on category, and first-in, first-out within each category. The PMEL management information system allows internal use of additional priority codes to meet mission requirements. All priority codes used in the PMEL shall be defined in the quality manual with EMERGENCY defined as the highest possible priority. Customers shall only request the following priorities:

a. EMERGENCY Calibration or Repair: One-of-a-kind TMDE that is inoperable or due calibration and for which a critical job is at a work stoppage. A letter of justification signed by the OWC maintenance supervision shall accompany the TMDE. The letter may be handwritten to prevent delay, and telephone verification between the OWC and PMEL is encouraged. The PMEL or AFPSL shall accept emergency TMDE any time and immediately place it into work, with calibration or repair action continuous until repair or calibration is completed or status of the item changes (e.g., AWP, deferred for lack of standards or technical data, etc.). The PMEL Manager may require an OWC technician familiar with the TMDE to accompany the TMDE to and remain at the PMEL to provide technical assistance until the work is completed or placed in an interim-complete status. The owning or using organization picks up the TMDE immediately upon notification of completion. For AFPSL items, the item shall be shipped to the Air Force Primary Standards Laboratory (AFPSL), Heath, Ohio, by priority means; and the supporting PMEL shall alert the AFPSL scheduler and AFMETCAL/MLLW with a telephone call or by message of the impending arrival of the priority; and the PMEL Manager shall sign a cover letter (suggest a form letter) requesting and justifying the priority.

b. MISSION ESSENTIAL Calibration or Repair: One-of-a-kind or one-deep TMDE that is part of a unit's deployment package, or is critical to daily peacetime operations, or TMDE assets falling below critical availability levels. A letter of justification signed by the OWC flight chief or equivalent shall accompany the TMDE. The OWC flight chief or equivalent may pre-identify, by letter, TMDE which meets the mission essential definition as approved by the PMEL Manager or delegated approval authority. The PMEL or AFPSL shall accept mission essential TMDE any time during duty hours and schedule it with sufficient priority to ensure the calibration/repair is complete, or the maintenance status changes (i.e., from INW to AWP, DEF, etc.), by the date and time specified by the customer. The OWC or using organization picks up the TMDE immediately upon notification of completion. For AFPSL items, the supporting base PMEL shall alert the AFPSL scheduler and AFMETCAL/MLLW with a telephone call or by message of the impending arrival of the priority; and the PMEL Manager shall sign a cover letter (suggest a form letter) requesting and justifying the priority.

c. ROUTINE Calibration or Repair: TMDE not categorized as emergency or mission essential. The PMEL or AFPSL shall accept routine TMDE during normal turn-in and pick-up hours. This is equivalent to the normal processing of TMDE in the PMEL or AFPSL.

3.8 CARE OF TMDE. Activities owning and using TMDE are responsible for its proper handling, transportation to and from designated drop off points, care, use, and cleanliness. These are important factors in ensuring that TMDE performs reliably within specified tolerances for the duration of the established calibration interval.

3.8.1 Physical characteristics of TMDE. Physical characteristics of TMDE range from sturdy to delicate. The sturdy can be outer cases with shock suppression mountings. The fragile can be components that can be damaged by a slight jolt, scratch, or static electricity. Special handling instructions for specific items are prescribed in maintenance T.O.s when handling requirements exceed normal practice. Electrostatic Discharge (ESD) control procedures are described in MIL-HDBK-263, MIL-STD-1686, and T.O. 00-25-234.

3.8.1.1 Items of TMDE shall be handled as "delicate instruments" regardless of outer physical appearance.

3.8.1.2 Two persons shall carry TMDE that is too heavy to be carried by one person (AFOSH STANDARD 91-46). If two persons cannot safely carry TMDE, a suitable mechanical device shall be used.

3.8.1.3 Items of TMDE shall be handled individually unless the item's size and physical characteristics allow it to be held in one hand.

3.8.1.4 External cords, cables, accessories, and special connectors shall be secured to the case before movement.

3.8.1.5 All unmated connectors shall be kept covered with moisture-proof and vapor-proof caps. Exceptions are when stored in environmentally controlled areas, or if subject to use on a daily basis. Unmated connectors on units that contain circuitry susceptible to ESD damage shall be covered with conductive caps (Ref T.O. 00-25-234, para 7.5d(12)(d). Do not substitute the use of tape for the caps.

3.8.1.6 Metal-to-metal contact between TMDE items shall be avoided unless the total instrument is contained in a protective case.

3.8.1.7 Only TMDE awaiting work, in delay status or delivery to the customer shall be stored in the PMEL receiving and shipping areas. If a portion of the area is used for other purpose(s), the area shall be well marked as to status or purpose of use.

3.8.1.8 All TMDE shall be stored on shelves or racks unless the physical characteristics prevent this type storage. Items of TMDE constructed so that the instrument is completely contained in a case may be stored on metal or wooden shelving without further protection. Care must be taken to protect protruding dials, knobs, or meter faces. TMDE not constructed in cases shall be protected from damage by use of suitable containers and appropriate padding. Containers, protective caps and coverings, and padding are not required for equipment in work or subject to use on a daily basis. Items of TMDE completely contained in packing cases may be stored on the floor.

3.8.1.9 TMDE shall be removed from service if it has been subjected to overloading, mishandling, gives suspect results, or otherwise determined to be defective. Properly tag and store the TMDE to prevent further use until it can be scheduled for repair or calibration.

3.8.2 Transportation of TMDE. Transportation of TMDE by trained personnel using a regularly assigned and specially configured vehicle will provide the maximum degree of protection to the equipment. Physical characteristics of individual TMDE shall dictate the extent of protection required during transportation. In general, protection from the elements and excessive shock and vibration is all that is required for TMDE in a protective case. Padding protection between items on the same vehicle may be required to protect knobs, dials, and meter faces from damage if the load shifts.

3.8.3 Cleaning TMDE. The user shall clean the exterior of all TMDE immediately before transporting to the PMEL. TMDE may be returned to the user for cleaning. When an item is disassembled in the calibration area of the PMEL and found to be dirty internally, the calibrating technician shall return the item to the cleaning room. Dust removal may be done in the calibration area by vacuuming only. Techniques for cleaning electronic equipment are provided in T.O. 00-25-234. These techniques may also be applied for electromechanical and physical standards when applicable. Oxygen TMDE shall be certified as clean by the user prior to shipment to the PMEL.

NOTE

Oxygen gages shall contain the warning OXYGEN-USE NO OIL printed on the face of the gage by the manufacturer or by use of the OXYGEN- USE NO OIL decal part number 69A52267 (T.O. 15X-1-102) or an equivalent statement of oxygen service. If the gage does not have the OXYGEN-USE NO OIL warning or decal or equivalent statement of oxygen service printed on the face or affixed to the gage, the PMEL shall not include the “Not Oxygen Clean” statement on the certification label.

3.8.4 PMEL Tracking of TMDE. Each item of equipment shall be labeled, marked or otherwise identified to indicate its calibration status. Records shall be maintained on each item of equipment and all materials significant to the calibrations or verifications performed. This includes entering into the PAMS, or equivalent data system, all standards that provide a traceable link to a certified parameter. The records shall be stored and held secure and in confidence to the customer for a minimum period of one year or the length of one calibration interval if the calibration interval exceeds one year. The intent is to have at least the last record in the file. The records shall include as a minimum:

a. Nomenclature

b. Manufacturer, type identification, and serial number or other unique identification

c. Current location, where appropriate

d. Where applicable, date calibrated, results of calibration and/or verifications, and date due calibration

e. Details of maintenance carried out to date and planned for the future

f. History of any damage, malfunction, modification or repair

g. The identity of the certifying technician

3.8.5 PMEL Handling of TMDE.

a. The PMEL shall have a documented system for uniquely identifying the items to be calibrated, to ensure there can be no confusion regarding the identity of such items at any time.

b. Upon receipt of the TMDE for calibration, any abnormalities or departures from standard condition as prescribed in the relevant calibration method shall be recorded on an AFTO Form 350 or equivalent document. Where there is any doubt as to the item's suitability for calibration, where the item does not conform to the description provided, or where any limited or special calibration required is not fully specified, the PMEL shall consult the customer for further instruction before proceeding. The PMEL shall establish whether the item has received all necessary preparation, or whether the customer requires preparation to be undertaken or arranged by the PMEL.

c. The PMEL shall have documented procedures and appropriate facilities to avoid deterioration or damage to the calibration item during storage, handling, preparation, and calibration. Any relevant instructions provided with the item shall be followed. Where items have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored, and recorded where necessary. Where a calibration item or portion of an item is to be held secure (for example: for reasons of record, safety or value, or to enable check calibrations to be performed later), the PMEL shall have storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

d. The PMEL shall have documented procedures for the receipt, retention or safe disposal of calibration items, including all provisions necessary to protect the integrity of the PMEL.

3.8.6 Computers and Automated Equipment Where computers and automated equipment are used for the capture, processing, manipulation, recording, reporting, storage, or retrieval of calibration data, the PMEL shall ensure that:

a. Computer software is documented and adequate for use.

b. Procedures are established and implemented for protecting the integrity of data. Such procedures shall include, but not be limited to, integrity of data entry or capture, data storage, data transmission and data processing.

c. Computer and automated equipment is maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain integrity of the calibration data.

d. Appropriate procedures for the maintenance and security of data, including the prevention of unauthorized access to and amendment of computer records are established and implemented.

3.9 PMEL MOBILE/ON-SITE MEASUREMENT CAPABILITIES.

3.9.1 Transportable Field Calibration Unit (TFCU). The TFCU consists of working standards, TMDE, and accessories. These items are mounted in shockproof transportable cases. The cases serve as equipment racks during

operation and provide protection during transit. The TFCU is used to augment a PMEL to provide on-site calibration support. The PMELs that possess and operate TFCUs are identified in Section 10.

3.9.1.1 TFCU working standards will operate satisfactorily within temperature ranges of 18°C (64°F) to 28°C (83°F) with humidity up to 70% RH. Depending on the TFCU working standard(s) used, calibrations performed outside of these ranges may result in a degradation of accuracy. Specific details on TFCU operating environment are available on the AFMETCAL PMEL website 'METWEB'.

3.9.1.2 TMDE with accuracy requirements beyond the capability of the TFCU shall be returned to the host PMEL. TMDE that needs more than minor maintenance shall normally be returned to the host PMEL.

3.9.1.3 A TFCU shall be considered for assignment to specific PMELs on a case-by-case basis to accomplish the following:

a. Provide calibration support to established Air Force and DoD agencies remotely located from a host-base PMEL.

b. Provide interim or emergency TMDE support at remote sites and bases where operating units have been deployed and where no support PMEL exists.

c. Permit PMELs to maintain and operate calibration support capabilities within prescribed geographic areas.

d. Provide calibration support at a location where an operation does not justify the establishment of a PMEL because of its limited size and workload.

e. Provide temporary support to augment a base PMEL during facility renovations, construction, natural disasters, or loss of environmental systems.

3.9.1.4 Requests for authorization for a TFCU or redistribution of a PATEC shall be submitted through the PMEL FAM to AFMETCAL Det 1 with an information copy to HQ USAF/ILMM. The requests shall include the following:

a. Identify the proposed owning activity, the purpose for which the TFCU (or PATEC) shall be used, and how it shall be supported.

b. Model or part number, manufacturer, nomenclature, and quantity of TMDE that requires on-site support.

c. The official military designation, squadron or unit, and major command for each activity that shall receive TFCU support.

d. The geographic location of each customer and distance from the host PMEL.

e. Alternate course(s) of action to provide support if the TFCU (or PATEC) is not authorized.

f. Statement of mission impact if a TFCU (or PATEC) is not obtained.

3.9.1.5 PMELs that have lost their on-site customers, which justified their need for a TFCU (or PATEC), shall contact AFMETCAL Det 1, and the command PMEL Functional Area Manager, for disposition instructions.

3.9.1.6 Any calibration support requirements that cannot be met within the above guidelines shall be returned to the main operating base for support.

3.9.2 Portable Automatic Test Equipment Calibrator (PATEC). The PATEC is used to calibrate ATE on-site. The PATEC consists of a set of portable standards designed to calibrate a specific ATE system. The PATEC standards are housed in portable cases. See paragraphs 3.9.1.4 and 3.9.1.5 for redistribution or turn-in process.

3.9.2.1 Environmental requirements are determined by the requirements of the ATE being calibrated.

3.9.2.2 Calibration of ATE using the PATEC shall be in accordance with 33K- or 33D-series T.O., as applicable.

3.9.2.3 The PATEC is normally assigned to a designated PMEL. There are cases where the PATEC is owned by the organization owning the ATE because of mission security, geographic, or deployment considerations. When a PATEC is built to support specific ATE, the activity owning the ATE shall have priority use, even though the PATEC may be held by the PMEL. The PATEC shall be available at all times for scheduled or unscheduled calibration of the specified ATE.

3.9.2.4 Supply procedures of AFMAN 23-110CD shall be followed for transfer and receipt of the equipment when the PATEC is intended to be used in the deployment mode.

3.9.3 Rapid Assistance Support for Calibration (RASCAL). RASCAL is a deployable PMEL with a down-sized measurement capability designed for rapid deployment to support emergency calibration needs. It is comprised of five NAVAIR shelters, measuring 8 ft wide and 20 ft long. These units are put together to form four measurement area shelters and one scheduling/receiving shelter. The four measurement area shelters provide calibration capability in the DC and Low Frequency, Microwave, Dimensional, and Electro-Mechanical areas.

3.9.3.1 RASCAL can be deployed using aircraft, air-ride trailers, or ships. Once deployed, RASCAL requires a 20,000 to 25,000 pound crane or forklift to complex the units. Based on various conditions, complexing time is approximately half a day.

3.9.3.2 RASCAL is equipped with Environmental Control Units (ECUs) designed to maintain interior temperature at 73 ±6°F and relative humidity at less than 50 percent.

3.9.3.3 RASCAL has the ability to be powered by either a commercial or a mobile generator type source.

3.9.3.4 Requests for RASCAL support shall be processed through MAJCOM PMEL Functional Area Managers.

3.9.4 Jet Engine Test Stand Calibrator (JETSC). TMDE and accessories needed to perform on-site calibration of jet engine test stands. They are housed in ruggedized cases, or in a trailer which has both a work and a storage area.

3.9.5 Other On-Site. At times it is not possible to return TMDE to the PMEL and calibrations must be performed on-site. When performing a calibration of TMDE designated PMEL responsibility outside of the controlled environment of the PMEL, additional care must be taken.

3.9.5.1 The temperature and humidity ranges of all standards and test items must be considered. Generally, base measurement standards should not be taken outside of the PMEL. Before taking a base measurement standard out of the PMEL, consult with AFMETCAL Det 1/MLEE or /MLEM.

3.9.5.2 Items assigned a calibration responsibility of 'PMEL (68Deg)' are calibrated at a nominal 20°C (68°F) and should not be calibrated outside of a controlled environment. If you have a specific need to make this type of measurement on-site, consult with AFMETCAL Det 1/MLEM.

3.9.5.3 Other measurements are performed at a nominal 23°C (73.4°F). On-site calibration should be held to an environment of 23 +/-5°C (73.4 +/-9°F) and <70% RH. If you have a need to perform an on-site calibration outside these environmental conditions, document the following:

a. End-item to be calibrated, manufacturer's stated operating environment, and applicable temperature coefficients.

b. Calibration authority, date of calibration, calibration interval, due date placed on end-item, and location of calibration.

c. Any limited calibrations noted on the calibration label or certificate (if applicable).

d. Calibration environment (temperature and humidity).

e. A list of all equipment to be used in the calibration, the manufacturer's stated operating environment, and applicable temperature coefficients for each piece of equipment.

f. Any environmental conditions detailed in the calibration authority.

g. The test uncertainty ratio for each measurement of the calibration environment (including the effects of any temperature coefficients). The test uncertainty ratio must be equal to or better than the test uncertainty ratio in the calibration authority.

h. This documentation shall be coordinated with the PMEL QA and maintained on file for the life of the calibration. Documentation should be made available to the AFMETCAL Det 1 Assessment Team upon request.

3.9.5.4 Environmental conditions must be monitored and documented for the calibration.

3.9.5.5 In all cases, PMELs shall conform to the maintenance T.O. or manufacturer's data regarding any environmental limitations or temperature coefficients of any item used in a measurement setup. The calibration authority may state specific environmental conditions, which shall be met, for the calibration.

3.10 PMEL MANAGEMENT RESPONSIBILITIES. The PMEL shall be organized and shall operate in such a way that permanent, temporary, and mobile facilities meet the requirements of this T.O.

3.10.1 Responsibilities of PMEL Commanders and Senior Level Management. Commanders and Managers in the PMEL chain of command shall ensure that:

a. The PMEL is maintained in a condition that facilitates effective mission performance. This includes an adequate environmental system.

b. TMDE requiring calibration is not used unless it has been calibrated and that it is removed from service once the calibration due date has expired.

c. Special attention is placed on personnel proficiency, PMEL manning, environmental control, quality assurance, material resources, and use of technical directives.

d. The PMEL provides maximum support to Air Force activities, other federal agencies, contractors (authorized to receive such support), and security assistance programs under the guidelines of AFI 25-201, AFI 21-113, AFI 99-101, and AFI 65-603.

e. Controls are established to ensure that TMDE is calibrated and certified as prescribed in this T.O., AFI 21-113, and T.O. 33K-1-100-2.

f. Vehicles used to transport TMDE are equipped to provide full protection to TMDE from damage that may occur from weather, vibration, or shock.

g. When PMEL measurement standards are not maintained or authorized at an installation or on an instrumentation ship, affected TMDE shall be calibrated by the closest PMEL. Support agreements shall be negotiated between the site or base and the supporting activity. Reference DoDI 4000-19 and AFI 25-201.

h. Continuing problems with PMEL customers regarding timely delivery of TMDE for scheduled calibration shall be elevated for resolution if the supervisor responsible for the OWC quality control cannot obtain results.

i. PMEL intermediate off-equipment TMDE maintenance production requirements are identified in operations plans when applicable.

j. The PMEL shall have managerial staff with the authority and resources needed to discharge their duties.

3.10.2 Responsibilities of PMEL Managers. The PMEL Manager is the senior on-site manager responsible for the overall PMEL, quality, and production control functions. The PMEL manager shall:

a. Ensure management procedures conform to the requirements specified in this T.O., command directives and applicable contractual requirements.

b. Organize the PMEL in such a way that confidence in its independence of judgement and integrity is maintained at all times. When there is a possibility of PMEL personnel being placed under pressure by customers or other sections of the organization, reporting relationships shall be established to isolate personnel from this pressure. The boundaries, expectations, and responsibilities of the employee in dealing with the customer may need to be specified in order to maintain independence of judgement and integrity.

c. Specify and document the responsibility, authority, and interrelation of all personnel who manage, perform or verify work affecting the quality of calibration.

d. Provide supervision by persons familiar with the calibration methods and procedures, the objective of the calibration and the assessment of the results. Management practices shall be such as to ensure adequate supervision.

e. Designate a technical manager (however named) who has the overall responsibility for the technical operations.

f. Designate a quality manager (however named) who has the overall responsibility for the quality system and its implementation. The quality manager shall have direct access to the highest level of management at which decisions are taken on PMEL policy or resources, and to the technical manager.

g. Designate alternates in case of absence of the technical or quality manager.

h. Where relevant, have documented policy and procedures to ensure the protection of customer's confidential and proprietary rights.

i. Participate in inter-PMEL comparisons and proficiency testing programs as required.

j. Establish and maintain a quality system in accordance with this T.O., and document quality policies and objectives in the PMEL quality manual in accordance with this T.O.

k. Use appropriate methods and procedures for all calibrations/verifications and related activities within its responsibility (including, but not limited to, sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of calibration data). TMDE shall be calibrated and certified in accordance with the requirements of this T.O., AFI 21-113, CMS T.O.s, T.O. 33K-1-100-1 and T.O. 33K-1-100-2.

l. Ensure documented procedures exist for the purchase, reception and storage of consumable materials used for the technical operations of the PMEL that can affect the results of calibrations.

m. Document policies and procedures for the resolution of complaints received from customers or other parties about PMEL activities. Specifically, records shall be maintained of all complaints and the actions taken to resolve those complaints. Complaints or other circumstance regarding compliance with PMEL policies, procedures, quality or the requirements of this T.O. shall be promptly resolved.

n. Submit the PMEL Report, RCS: HAF-ILM(SA) 7808, and the PMEL Inventory Listing, RCS: HAF-ILM(A) 9450, as specified in Section 6 ensuring accurate data and on-time submission.

o. Establish a Quality Program (QP) in accordance with this T.O. and any applicable command directives.

p. Ensure all levels of management are aware of the importance of PMEL environmental conditions play in timely and accurate mission support. Locally imposed measurement restrictions and procedures shall be developed to ensure calibrations are not accomplished when environmental conditions are outside prescribed specifications. These procedures and restrictions shall be documented in a log when the facility environment deviates from prescribed tolerances. It is incumbent upon PMEL managers to be aware of PMEL environmental outages that may impact the PMEL ability to successfully support mission requirements. Should excessive outages occur, appropriate actions such as work requests to civil engineering, requests for upper level management involvement etc., shall be accomplished.

q. Ensure technicians who certify TMDE are appropriately qualified/trained.

   (1) Annual calls and out of cycle requests for technical training course quotas through the Pipeline Management System (PMS).

   (2) Submission of Training Quality Assessments IAW AFI 36-2201.

   (3) Submission of AF Form 403, Request for Special Training.

   (4) Career Development Course reviews.

r. Initiate and maintain an effective safety program that includes a fire safety program per the applicable safety standards (AFOSHSTD 91-56, AFOSHSTD 91-90).

s. Process items of TMDE identified as being beyond the PMEL capability to repair or calibrate in accordance with this T.O., T.O. 00-25-107, T.O. 33-1-27, and AFMAN 23-110CD.

t. Minimize the use of PMEL personnel for the performance of clerical, supply, and equipment cleaning duties. Personnel trained in these skills should perform these duties.

u. Deliver and return items of TMDE that are fragile or subject to environmental damage and require support from other laboratories by courier. PMEL technicians shall not be used for courier duty unless they are to receive specialized TMDE training at the other PMEL.

v. Coordinate calibration support with medical equipment personnel in accordance with AFMAN 23-110CD.

w. Ensure measures are taken to ensure good housekeeping in the PMEL. Optimum cleanliness shall be maintained. No eating, drinking, smoking, or use of other tobacco products shall be permitted in the calibration and repair areas unless specifically authorized in Section 8.

x. Minimize the location of purely administrative functions within the calibration and repair area of the PMEL. Completion of the necessary forms used for certification is not considered an administrative function.

y. Establish a TMDE Coordinator training program.

z. Establish a system to control test fixtures. The system shall provide for:

(1) An identity on the test fixture that can be related to the equipment/calibration procedure for which the test fixture was fabricated.

(2) A storage area for test fixtures not permanently used in measurement setups.

(3) An index or reference file that identifies the test fixture and its storage location.

aa. Take necessary actions to minimize the late delivery of TMDE for scheduled calibration.

bb. Notify the OWC if a deficiency is discovered with the physical condition or documentation that affects the ability to calibrate or repair the item.

cc. Maintain a T.O. File on the use and operation of all relevant equipment, on the handling and preparation of items, and for calibrations/verifications. All instruction, standards, manuals and reference data relevant to the work of the PMEL shall be maintained up-to-date and readily available to the staff. T.O.s will be filed in any type of binder which will protect and facilitate the use of the T.O. (T.O.00-5-2 paragraph 3-9.1). Individual 33K T.O. can be filed in individual file folders that can be color-coded to indicate the 33K series (such as K6 - Dimensional - blue). The file shall also be filed in an alphanumeric sequence. AFTO Form 57, described in Section 5, can be used in the folder to document data peculiar to each T.O..

dd. Provide priority maintenance to mission essential TMDE. This is TMDE used in direct support of systems required to meet wartime tasking.

ee. Ensure Requests for Calibration Responsibility Determination are not submitted for equipment owned and used by departments outside the Air Force. Such a customer is responsible to give the PMEL the capability to support new equipment, if the PMEL doesn't already have it.

ff. Perform initial testing on new items when the PMEL has the capability, a calibration procedure exists, or adequate commercial data or maintenance T.O. data is available to permit testing.

gg. Identify non-PMEL TMDE, identical in part number or model to PMEL standards, to any off-base organization to which they are sent for calibration. This permits the certifying technician to determine the correct calibration procedure.

hh. Maintain the security of the information in PAMS by exercising proper control of the access codes, and administer, maintain, and operate the PAMS in accordance with applicable regulations, manuals, and command instructions. Reference AFCSM 21-303 Vol 2

ii. When requested by the OWC prior to the local purchase of new TMDE, verify there is no available existing TMDE that can be used to satisfy the requirement, and determine if the item is already listed in T.O. 33K-1-100-2.

3.11 QUALITY SYSTEM. A quality system is defined as the organizational structure, responsibilities, procedures, processes, and resources for implementing quality management. A quality system includes everything a PMEL does that affects the quality of the services provided. The elements of a PMEL's quality system shall be documented in a

quality manual. The quality manual shall define and document the PMEL policies and objectives for, and commitment to, good PMEL practices and quality calibration services. The quality manual shall be issued under authority of the PMEL Manager and made available for use by all personnel.

3.11.1 QUALITY MANUAL. The purpose of the Quality Manual is twofold. First, it provides an organized way of communicating how the PMEL's quality is managed both to personnel working in the PMEL and to external parties such as base and corporate management, customers, and auditors. Second, it provides a basis for orienting new personnel on their roles and responsibilities under the PMEL quality system and how the quality system is implemented in the PMEL. The Quality Manual shall be reviewed annually by PMEL management to ensure the objectives of the quality system are being met and to introduce improvements. This review shall be documented. The quality manager shall maintain the Quality Manual in current status, and as a minimum, it shall include or reference the location of the following information:

a. Management Policy Statements. This section shall contain management's quality policy statement, including objectives for, and commitment to, good PMEL practices and quality of calibration services.

b. Organization and Management. This section shall contain a chart showing the organization and management structure of the PMEL, including its place in any parent organization and related organization charts.

c. Records. This section shall contain the procedures, responsibilities, and authorities for drafting, changing, approving, and issuing quality system documents. This includes the Quality Manual, related quality documentation such as local procedures and forms (e.g., PR, SR, and QR review forms), internal audits, management reviews, customer complaints, etc.

d. Personnel. This section shall contain a description of the responsibilities and key duties of the PMEL Manager, Technical Manager, and Quality Manager.

e. Training. This section shall identify the PMEL training requirements and methods used to obtain the required training.

f. Signatories. This section shall identify the signatures required and specific personnel authorized to sign or approve PMEL documents. Signatories shall be selected based on their qualifications to make the required decision. Signatories of calibration results shall be responsible for the adequacy of the results.

g. Accepting New Work. This section shall contain the procedures for reviewing new work, such as local procedures for completing AFTO Forms 45. This process shall ensure the PMEL has the appropriate support agreements, facilities, equipment, standards, and technical expertise necessary to support the new work.

h. Calibration Procedures. This section shall contain or reference local procedures for requesting, posting, controlling, and using calibration and maintenance procedures.

i. PMEL TMDE. This section shall outline local procedures to ensure calibration, verification, and maintenance (including preventive maintenance) of equipment owned, rented, or leased by the PMEL.

j. Quality Programs. This section shall contain local quality assurance objectives and practices. This includes specific management policies for meeting requirements of the QP. Also include the local guidance for participating in applicable AFMETCAL proficiency testing programs.

k. Recall and Notification. This section shall contain the decision process for recall of TMDE when a PMEL standard or critical customer-owned TMDE is found to be out-of-tolerance (when root cause analysis determines the out-of-tolerance condition could have affected Air Force mission systems). This element includes nonconformities discovered during QP reviews, internal audits, and management reviews.

l. Exceptions and Limitations. This section shall contain PMEL management's policy and process for permitting departures from calibration procedures, such as, permitting limited and special calibrations. Include the local process for permitting exceptions to published calibration determinations, such as, calibration interval and calibration responsibility.

m. Submitting Changes. This section shall contain local procedures for submitting changes to calibration procedures, calibration intervals, technical orders, and any other documents affecting quality of work produced. Include local procedures for completing AFTO Forms 22.

n. Measurement Uncertainty. This section shall contain the PMEL's process for determining measurement uncertainty and calibration accuracy when substituting equipment or when using a calibration authority other than 33K series procedures.

3.11.2 INTERNAL AUDITS AND REVIEWS.

3.11.2.1 Internal Audits. The PMEL shall perform annual internal audits to verify that operations continue to comply with the requirements of the quality system. A quality audit ensures that the PMEL is operating in accordance with the policies and procedures specified in the Quality Manual, this T.O. and any other contractual or directive quality documents. Persons possessing the knowledge and skills necessary to understand the process being audited as well as the process of auditing shall conduct the audit. If possible, auditors should be selected from personnel independent of the area being audited. Where the audit findings and root cause analysis conclude there is reason to doubt the correctness or validity of calibration results, the PMEL shall take immediate corrective action and initiate established recall procedures as necessary. Active observation and documentation of biannual AFMETCAL assessment will satisfy this requirement. Perform independent internal audits halfway between AFMETCAL assessments.

3.11.2.2 Management Reviews. PMEL Management shall review the quality system at least once a year to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements. The findings of each management review shall be recorded, the resulting action items assigned an estimated completion date, and the actions completed or revisited in the specified timeframe. Management reviews shall include:

a. Review of existing processes and procedures

b. Reports from managerial and supervisory personnel

c. The outcome of recent internal audits

d. Corrective and preventive actions

e. Assessments by external bodies

f. Results of inter-laboratory comparisons or proficiency tests

g. Changes in the volume and type of the work

h. Customer feedback and complaints

i. Quality program activity

j. Training

SECTION 4

CALIBRATION ASSISTANCE AND SUPPORT AGREEMENTS

4.1 REQUESTS FOR CALIBRATION ASSISTANCE. Calibration assistance from another PMEL or AFMETCAL Det 1 may be requested when a PMEL lacks the capability to calibrate assigned TMDE. The PMEL requiring support shall notify their respective PMEL FAM of the part number(s) requiring calibration and the reason they can not support the item(s). Request assistance as follows:

a. Request assistance from nearby Type IIB or IIC PMEL. If not available, proceed to paragraph b.

b. Request assistance from geographic supporting Type IIA PMEL (see Figure 4-1).

(1) Theater Type IIA (PACAF and USAFE) shall forward a request to the ALC Type IIA and inform the customer if they lack the capability.

(2) If the Type IIA normally has the capability but is temporarily out of service (temporarily down, etc.), it is the Type IIA's responsibility to seek lateral support before contacting AFMETCAL Det 1, as necessary.

(3) If the Type IIA does not have the capability and has never had it, they shall forward the request to AFMETCAL Det 1.

(4) Requests for documentation of the Type IIA PMEL assistance shall be required at the request of the servicing Type IIA PMEL. The request shall contain the following information for each item:

(a) National Stock Number.

(b) Model/Part Number.

(c) Manufacturer.

(d) Serial Number/ Bar Code.

(e) Nomenclature/Noun.

(f) Quantity.

(g) Ranges/Parameters/Accuracy or specific points/values/accuracy requiring calibration.

(h) WUC/Calibration Authority Source (K100-2, CMS, etc.).

(i) The calibration procedure, or commercial data if no T.O. has been published (Data shall be returned to customer).

(j) Priority (Per paragraph 3.7).

(k) Date Required.

(l) Location of Item.

(m) Specific reason why item cannot be calibrated.

(n) Permanent or temporary support.

c. Request assistance from AFMETCAL Det 1.

(1) Technical assistance from AFMETCAL Det1 consist of:

(a) Identifying Air Force support locations.

(b) Obtaining support from NIST or USNO when required.

(c) Identifying interservice or contractual support.

(2) AFMETCAL Det 1 shall advise how calibration support shall be provided and provide instructions for delivery of the equipment.

(3) No equipment shall be forwarded to AFPSL without prior coordination with the AFPSL scheduling section (DSN 366-5472/5473).

4.1.1 Unscheduled AFPSL Items. Unscheduled calibration support of items designated AFPSL responsibility shall be coordinated with the AFPSL scheduling section (DSN 366-5472/5473).

4.1.2 Maintenance Support Assistance. Maintenance support assistance required by the PMEL over and above their capability shall be obtained using the instructions contained in T.O. 00-25-107.

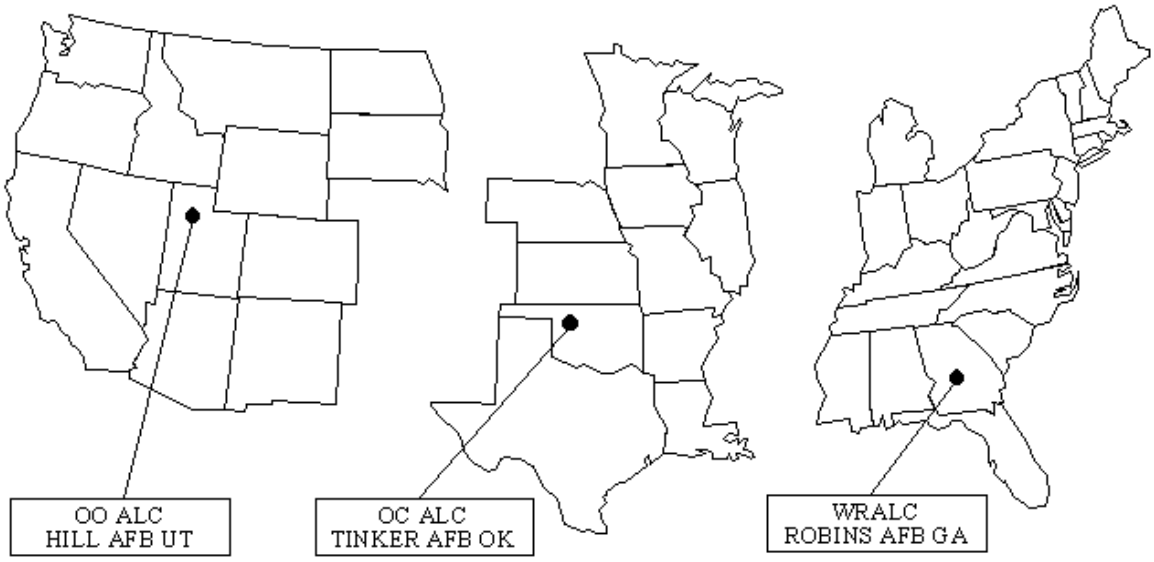

Figure 4-1.
AIR LOGISTIC TYPE IIA CONUS AREAS OF RESPONSIBILITY

* USAFE obtains support from RAF Feltwell UK, IIA PMEL
* Elmendorf AFB AK, IIA support area includes Alaska
* WR-ALC PMEL also supports USAFE including the Azores
* Western and central pacific areas obtain support from Kadena AB JA, IIA PMEL
* OO-ALC PMEL also supports Elmendorf AFB AK and Kadena AB JA

4.2 TECHNICAL/ENGINEERING ASSISTANCE. Requests for technical and/or engineering assistance on specific metrology problems that cannot be resolved by the PMEL or T.O. 00-5-1 shall be submitted to AFMETCAL Det 1. PMELs requesting assistance shall furnish a comprehensive description of each problem and advise if on-site assistance is recommended.

4.3 CALIBRATION, REPAIR & RETURN, AND LOAN. TMDE may be processed between PMELs on a repair and return; calibrate and return; or repair, calibrate, and return basis. Loan of TMDE between PMELs is authorized IAW procedures outlined in AFMAN 23-110CD. This maintenance concept is used when it is necessary for a PMEL to obtain maintenance assistance from an off-base PMEL. These transactions shall be coordinated between the PMELs involved. If the equipment is not to be sent to the PMEL, but to the depot or TRC, it shall be necessary to follow the procedures in T.O. 00-25-107 prior to movement of the equipment. After notification from the off-base PMEL that the required support can be given, the TMDE shall be delivered by courier or shipment. TMDE delivered and returned by courier shall not be processed through supply channels at either the supported or supporting PMELs location. Items of TMDE shipped through transportation channels shall be processed in accordance with established directives. In the event the TMDE is placed in awaiting parts status, the supporting PMEL shall notify the supported PMEL immediately and provide an estimated delivery date for parts and an anticipated completion date. If the Type IIA PMEL cannot perform the required maintenance, the procedures outlined in T.O. 33-1-27 shall apply. T.O. 00-25-115 identifies the ALC responsible for management of each stock class and for specific weapon systems/subsystems.

4.4 PMEL SUPPORT AGREEMENTS

4.4.1 Definitions

4.4.1.1 Interservice Support. Action by one military service or element to provide logistic support to a different military service or element.

4.4.1.2 Interdepartmental/Agency Support. Provision of logistics support by the military services to departments or agencies or the United States government (other than military) with or without reimbursement.

4.4.1.3 Host-Tenant Support Agreement. An intraservice agreement recorded on an AF Form 149 between active Air Force, ANG, or AFRC units (as required).

4.4.1.4 Unique Support Equipment. Equipment required solely to support the customer's equipment shall be provided by that customer if the customer is not Air Force, ANG, or AFRC. The Air Force is not required and shall not be tasked to build up a capability at Air Force expense that is used only to support another military service or federal department.

4.4.2 Generating Agreements. Regional support requirement external to a PMELs parent unit may require a wide variety of documented agreements. The intent of this paragraph is to assist the PMEL manager in performing their task in generating an agreement if AFI 25-201 specifies a requirement or there is a need to generate an interservice agreement per DoDI 4000.19. PMEL managers require a working knowledge of support agreements and financial procedures to ensure resources are available and adequate to provide customer support. They also generate procedures to maintain communications to ensure mission support needs within a PMEL's area of responsibility are met. PMEL managers (or PMEL contract managers) shall also be aware of how and when to charge customers for services rendered. AFMC Type IIA calibration laboratories typically are not required to generate Host Tenant support agreements when servicing other PMELS. Agreements that could be encountered are:

a. Host-tenant (AFI 25-201, AFI 65-601, Vol 1)

b. Interservice/Interdepartmental/Agency (DoDI 4000.19) Interservice and Intergovernmental Support.

4.4.2.1 The following policies shall apply when generating support agreements:

a. Support of other Air Force Units. Consider:

(1) Facility Requirements.

(2) Cost, Reimbursement.

(3) Manpower Authorizations Required and Source of Spaces and Funding.

(4) Effect on PMEL parent unit's Operations Plan. Consider what shall be PMELs role.

(5) Training Requirements, User and PMEL.

(6) Equipment, Parts, and Technical Data Requirements. Customers are responsible to provide any material needed to support locally purchased items.

(7) Priority of Work, Customer's FAD and Precedence Rating. [USAF Programming Directive - (PD)].

(8) Customer's Wartime Requirements and Priorities.

(9) Overdue Procedures.

(10) PMEL Assistance to Customer.

(11) Deficiency Reporting Procedures.

(12) Contract Maintenance and Calibration.

(13) Off-base Shipping and Transportation.

(14) Organizational Maintenance.

(15) Scheduling File Maintenance.

(16) Exercise or Mobility Support.

(17) Mission Changes.

(18) Unique Equipment Maintenance Cost.

(19) Support Requirements for Locally Procured TMDE.

(20) Workload.

b. Support of non-Air Force units: Agreement is required on: all items listed in 4.4.2.1a and the following:

(1) Forms and Labels to Use.

(2) Calibration Intervals to Use.

(3) Scheduling and Management Procedures.

(4) Calibration Procedures to Use.

(5) Responsibilities.

c. Support from non-Air Force sources: Agreement is required on all items listed in 4.4.2.1a and the following:

(1) Forms and Labels to use.

(2) USAF CMS and T.O. 33K-1-100-2 Intervals shall be used.

(3) Scheduling and Management Procedures.

(4) USAF Calibration Authorities shall be used.

(5) Responsibilities.

d. Agreements can be simplified if PMELs have a base regulation established that contains policy, assigns responsibilities, directs actions, and prescribes procedures tailored to meet local needs and is referenced in the agreement. Base regulations apply to all organizations assigned or attached to the base or tenant organizations. They also apply to off-base and remote-site organizations of the same or different parent command if the subject matter relates directly to support and services furnished them by the issuing base.

NOTE

Do not submit a Request for Calibration Responsibility Determination for non-Air Force customer assets. Other agency customers are responsible for providing the calibration procedure to be used, or, the specifications and accuracies required. Do not ask AFMETCAL Det 1 to write a calibration procedure or provide special equipment. It is the customer's responsibility to provide material resources the PMEL needs to assist them unless the PMEL already has the capability.

e. Policy, information, and procedures may be prescribed in a letter or message when there isn't time to process a publication. Letters or messages have to be replaced by a formal publication as soon as possible (AFI 33-360 Vol 1).

f. Financial Administration. Information on financial matters, budgeting reimbursement, etc., is found in AFI 65-601 Vol 1 and DFAS-DER7010-1.

g. Support Agreement Assistance. Assistance for development of support agreements and resolution of problems can be obtained from:

(1) Base Level Office Primary Responsibility (OPR) for support agreement.

(2) Parent Command PMEL Functional Area Manager (AFI 21-113), or Command Support Agreement Functional Area Manager.

(3) Air Force Material Command (AFMC), AFMETCAL Det 1 is the Air Force point of contact for International Calibration Support.

(4) HQ USAF.

(a) Directorate of International Programs.

(b) International Logistics Planning and Policy.

(5) Support Agreement References.

(a) AFI 25-201, *Support Agreement Procedures.*

(b) AFI 38-201, *Determining Manpower Requirements*.

(c) AFI 21-113, *Air Force Metrology and Calibration Program.*

(d) Federal Acquisition Regulation (FAR).

(e) DoDI 4000.19, *Interservice and Intragovernmental Support.*

(f) DFAS-DER7070-3, *Financial Management and Accounting for Security Assistance and International Programs.*

(g) COMMAND 21-XX, *Maintenance Management.*

(h) AFI 65-601V1, *Budget Guidance and Procedures*.

4.4.3 Negotiation, Administration, and Review. Each military service is responsible for providing or arranging for support of its own forces. Maximum practical use of support agreements shall be made when overall economies can be realized without impairing military effectiveness.

4.4.3.1 Support agreements shall be generated only when necessary. Support agreements shall be negotiated at the lowest possible organizational level; customer to PMEL, for instance. This is with the concurrence of the base OPR for the agreement. PMEL managers shall coordinate on all agreements that include provisions of PMEL support.

4.5 COMMERCIAL/CONTRACT CALIBRATION OF TMDE.

4.5.1 Commercial Calibration of TMDE. The following policies pertain to commercial calibration of TMDE.

4.5.1.1 General. **AFMETCAL Det 1 is the only authority for approving commercial calibration service**. Calibration of TMDE shall be performed by the PMEL unless AFMETCAL Det 1 has approved the commercial calibration. Do not submit a request to AFMETCAL Det 1 for commercial calibration service until requests for lateral support from other PMELs or the AFPSL have been exhausted. Do not submit requests for commercial calibration service to AFMETCAL Det 1 for TMDE not listed in T.O. 33K-1-100-2 or applicable CMS until an AFTO Form 45 has been submitted and processed. When authorized to contract any part of the calibration, this work shall be placed with a laboratory complying with the requirements of ISO Std 17025 or ANSI/NCSL Z540-1-1994.

4.5.1.2 Procuring TMDE Involving Commercial Calibration. Item and program managers procuring TMDE involving commercial calibration shall submit a data call to AFMETCAL Det1 prior to contract award.

4.5.1.3 Requests for Commercial Calibration Service. See Director's Guidance Memorandum "Procedure for AFMETCAL Coordination on Request for Commercial Calibration Support" for details of requesting commercial calibration service. The requester shall ensure and be able to provide documentation that the contractor is competent to perform the activities in question and complies with the same criteria of competence as an USAF laboratory. AFMETCAL Det 1 shall, at its discretion, determine if additional data or a site visit is required. The requester shall advise the customer of its intention to contract any part of the calibration to another party. The requester shall record and retain the details of its investigation of the competence and compliance of contractors and maintain a register of all contractors. The calibration results will normally be reported in a calibration certificate/report (see Section 5).

4.5.1.4 Intervals for Commercially Calibrated Items. The intervals for commercially calibrated TMDE shall be in accordance with any applicable CMS or T.O. 33K-1-100-2. The appropriate Air Force certification label shall be affixed to the TMDE in accordance with paragraph 4.5.3. The calibration interval on commercially calibrated TMDE starts the date the contractor calibrated the item.

4.5.1.5 Commercial Repair of TMDE. Unless approved by AFMETCAL Det 1, commercial repairs performed on customer TMDE shall be verified by the PMEL when the PMEL has the capability and the responsibility to calibrate the item. Calibration of TMDE shall be performed by the PMEL whenever possible, rather than accept commercial certifications performed in conjunction with commercial repairs.

4.5.2 Contract Calibration of TMDE. The following policies pertain to items listed within CMS T.O.s and T.O. 33K-1-100-2 with a calibration responsibility identified as **N49**, **N59**or **N64**.

4.5.2.1 General. AFMETCAL Det 1 has responsibility for management of all calibration services for Air Force TMDE listed as **N49, N59** or **N64**. AFMETCAL Det 1 shall fund and perform all contracting functions necessary to obtain calibration services from both the private sector as well as other DoD agencies. Fund cites will no longer be required by the field. The AFPSL shall provide PMELs and owning work centers with disposition instructions as their requests for calibration services are received. Equipment requiring calibration under Depot Maintenance Activity Group (DMAG) or Stock Funded programs shall not be serviced or funded under this process unless a reimbursement agreement has been established. The PMEL shall not accept or process non-AF N49, N59 or N64 contract calibration workload.

4.5.2.2 Request for Contract Calibration Support. In order for the PMEL or owning work center to obtain contract calibration services for items listed within CMS T.O.s and T.O. 33K-1-100-2 as N49, N59 or N64, contact the appropriate workload scheduler. See Director's Guidance Memorandum "Laboratory Procedures for AFMETCAL Contract Calibration Support" for scheduler information and instructions.

4.5.2.3 PMEL and Owning Work Center Relationship. It is the responsibility of the PMEL to notify the customers within the PMEL's geographic region that Air Force contract calibration management has been centralized at AFMETCAL Det 1. To obtain calibration support, Air Force customers shall submit their request for calibration services directly to the appropriate workload scheduler as directed within para 4.5.2.2. The PMEL is encouraged to assist customers with process implementation and technical difficulties when ever possible. It is the responsibility of the owning work center to coordinate with the appropriate workload scheduler on all requests for calibration services.

4.5.2.4 Workload Scheduling. Schedule **N49**, **N59** and **N64** designated items as follows:

a. PMELs - Prior to shipment of TMDE from the PMEL, MDC data shall be entered into the PAMs system. This may be accomplished by utilizing action taken code "D" and disposition code "6". When calibration is complete and TMDE is returned, document MDC in PAMs utilizing action taken code "X" and disposition code "A" and update the warranty date field.

b. Owning Work Centers - Shall contact the AFPSL scheduler directly and are required to maintain their scheduling records.

4.5.2.5 Shipping and Logistics.

4.5.2.5.1 Equipment shall be shipped from the user's location directly to the service provider location as per the disposition instructions provided by the Air Force, Navy or Army workload scheduler. Owning organizations may ship equipment through the PMEL if the PMEL has given specific instructions to do so. Shipping expenses to the calibration destination shall be the responsibility of the owning organization. The appropriate calibration service provider shall be responsible for return shipping expenses. Questions or comments concerning turn-around time or contractor service should be directed to the AFPSL, Army Primary Standards Laboratory (APSL), or other Army/Navy workload scheduler. Any problems not resolved with the appropriate workload scheduler shall be directed to AFMETCAL Det 1. To ship the item, deliver the TMDE, a completed DD Form 1149, and an appropriate reusable shipping container to the local LGTT office. The DD Form 1149 shall be completed according to AFI 24-201, attachment 7, and applicable MAJCOM Maintenance Management Instruction 21-101. Ensure instructions are enclosed in the shipment to direct the shipping destination to return signed copy of the packing slip. Mark one copy of the DD Form 1149 "ADVANCE COPY" and send (mail, FAX, e-mail, etc.) it to the calibration destination.

4.5.2.5.2 Upon return of the calibrated equipment, the owning work center shall perform an incoming acceptance inspection (conformance assessment for physical condition, safety, documentation, and cleanliness). Ensure the equipment has the appropriate certification certificate or certification label. Contact the AFPSL workload scheduler if the unit does not conform in any way or documentation is insufficient. If the TMDE is determined to be unserviceable, the owning work center shall prepare and submit SF Form 368, Product Quality Deficiency Report. If the TMDE is determined to be serviceable, then the owning work center shall complete DD Form 250, Material Inspection and receiving Report, or equivalent document. A copy of the DD Form 250 or commercial equivalent shall be forwarded to AFMETCAL Det 1 to ensure contractor payment for services performed. For N49 and N59 items, please forward to AFMETCAL Det 1/MLLW, and for N64 items, AFPSL 813 Irving-Wick Drive West, Heath, Ohio 43056-6118.

4.5.2.6 Intervals for N49, N59, and N64 Calibrated Items. The intervals for N49, N59, and N64 calibrated TMDE shall be in accordance with any applicable CMS or T.O. 33K-1-100-2. The appropriate Air Force certification label shall be affixed to the TMDE in accordance with paragraph 4.5.3. The calibration interval starts the date the contractor or DoD agency calibrated the item.

4.5.2.7 Repair During Contract Calibration. Incidental repair during calibration shall be accomplished and funded by AFMETCAL Det 1. Funding shall be provided for incidental repair only. If a unit is shipped which is in need of major repair, the owning organization will be contacted by AFMETCAL Det 1 for a fund cite and/or disposition instructions. AFMETCAL Det 1 must grant approval for major repair actions.

4.5.3 Certification Label. The commercial or DoD agency source certification label shall remain on the unit. An AF certification label shall be attached to the TMDE citing "T.O. 00-20-14" in the authority block. Also, enter an annotation in the special block, referencing the non-AF certification label or certificate, and any additional certification data associated with that calibration. The PMEL or owning work center shall retain contractor certificate of calibration, and warranty document on file until warranty expiration. If data contained within the certification label, calibration certificate, or certificate of traceability is incorrect, notify the appropriate workload scheduler for instructions.

4.6 CALIBRATION SUPPORT FOR SITE ACTIVATION TASK FORCE (SATAF), OPERATIONAL TEST AND EVALUATION (OT&E),and INITIAL OPERATIONAL TEST AND EVALUATION (IOT&E).

4.6.1 General. (Reference DoDI 5000.2 AF SUP 1 and AFI 63-111.) Calibration support for activation of new sites or upgrading of operational site equipment by Air Force contractors shall be provided in accordance with host-tenant agreements established under the provisions of AFI 25-201. AFMETCAL Det 1, in coordination with the program manager and the commands involved, shall develop the necessary calibration support plans and alert the selected PMEL of the projected workload and responsibility to support the installation and checkout contractor. The responsible PMEL shall initiate action in accordance with the plan to obtain equipment and manning to support TMDE to be utilized by the installation, checkout, and acceptance teams and during the subsequent operational phase. This support is normally limited to:

a. TMDE listed in any applicable CMS or T.O. 33K1-100-2 as PMEL responsibility.

b. TMDE that is scheduled to remain on-site for use during the operational phase.

c. The PMELs existing capability.

NOTE

Equipment, which will not be used during the operational phase, shall be identified by the PMEL as equipment requiring alternate support.

4.6.2 Requests. Requests for support of contractor-owned TMDE shall normally be received from one of the following sources:

a. The administrative contracting officer.

b. The SATAF or project officer.

c. The local base procurement officer.

d. AFMETCAL Det 1 through one or more of the above.

4.6.3 Application. These provisions also apply for tests on new or improved systems at system or subsystem sites.

4.7 SECURITY ASSISTANCE (SA) PROGRAMS AND FOREIGN MILITARY SALES (FMS). FMS cases for the sale of systems to friendly nations often involve the necessity of establishing or augmenting a metrology program for that system. AFMETCAL Det 1 develops specific metrology programs providing for the repair and calibration of TMDE and follow-on calibration support. All queries for FMS cases or SA Programs shall be directed to AFMETCAL Det 1, 813 Irving-Wick Dr W, Heath, OH 43056-6116.

4.8 TMDE WARRANTIES. TMDE initially issued to using activities is frequently covered by a provisional warranty from the manufacturer. These warranties vary in degree of coverage, specific service/maintenance performed, and correction of design, material, and workmanship deficiencies, which result in the item of TMDE performing below specification and contractual requirements. Detailed information on specific warranty provisions is explained in AFMAN 23-110CD.

4.8.1 New Equipment Receipt. Upon receipt of new equipment PMEL shall:

a. Determine warranty expiration date. Complete and mail any warranty cards.

b. Calibrate the equipment, or, if repair is required and is covered by warranty, return to user with appropriate information required to promptly send the item through Base Procurement and contracting office IAW applicable regulations.

c. After calibration, whenever reasonable and conditions permit, short cycle the next date due calibration so the item is due back in the PMEL no later than 30 days prior to warranty expiration date.

d. Consider centrally procured items with warranties that fail calibration as subjects for Product or Quality Deficiency Reports.

4.8.2 Warranty Processing. Processing of a warranty action is at the discretion of the local contracting office. If the local contracting office requires an AF Form 9, it shall be submitted. Ref AFMAN 23-110CD Vol 1, Part 2, Chapter 10j.

4.8.3 Shipping Documentation. The requested maintenance priority (Priority 1, 2, or 3) shall be clearly marked on the shipping document, DD Form 1149, advance and equipment copies. The responsible receiving scheduler shall contact the shipping base PMEL when a unit arrives without a cover letter but is identified as a priority 1 or 2 on the shipping document. If a cover letter has not been generated, the item shall be processed as routine. Shipping requirements for Priority 1, 2, and 3 shall be coordinated with local transportation specialists to ensure shipping delays are minimized.

SECTION 5

PREPARATION AND USE OF CALIBRATION FORMS AND LABELS

5.1 TMDE CERTIFICATION STAMP (K STAMP). The K Stamp is a PMEL technician's official signature on those forms, tags, or labels described in this T.O. and applicable command directives. It shall be used only on these forms. Using an electronic version of the K stamp is authorized. The use of K stamps by PMEL technicians is mandatory on all certification labels. The PMEL manager shall designate who will be issued stamps. Stamps shall be serially numbered to identify the technician or supervisor and the activity to which he or she is assigned. The K stamp shall be as illustrated in Figure 5.1. The use of a stamp with smaller or larger dimensions is optional, provided it is dimensionally proportional and does not exceed the space available on forms. The K stamps shall be obtained through local purchase.

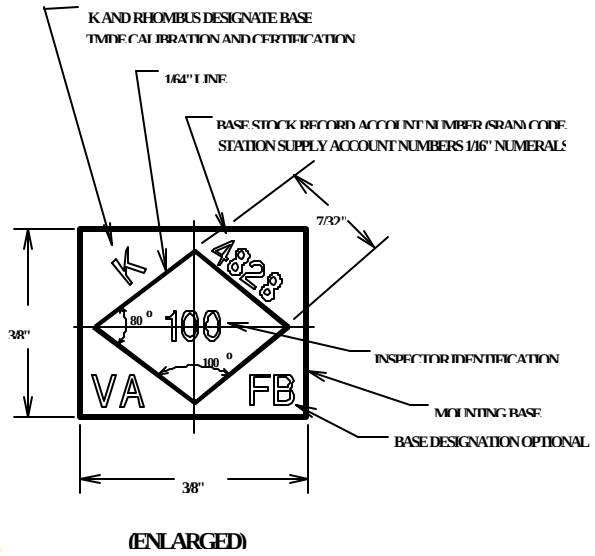

Figure 5-1.
TMDE CERTIFICATION STAMP (K STAMP)

5.2 GENERAL INSTRUCTIONS. The forms and labels in this section are mandatory unless otherwise noted. All written entries on labels and forms shall be in non-smearing permanent black or dark blue ink. Approval to use computer generated forms and labels controlled by this section can only be obtained by AFMETCAL Det 1 IAW AFI 33-360,V2.

NOTE

Anyone having trouble with one of the following labels or forms, due to their manufacture, shall report it to AFMETCAL Det 1.

5.2.1 Affixing Labels.

5.2.1.1 Only authorized personnel shall affix labels.

5.2.1.2 When affixing labels, do not cover TMDE identification data (part or serial number, etc). Also, do not affix labels where they would prevent use of TMDE (i.e., covering controls or control markings).

5.2.1.3 Always affix Bar Code Labels and certification labels where the user will see them during normal handling and use of the TMDE. Affix labels to a clean surface on the TMDE mainframe if possible, not on removable parts or panels. In the following instances, it may not be possible to affix labels to the TMDE:

a. The TMDE is too small to affix a label or its nature will not allow affixing of a label (optical flats and gage blocks). In these cases, the label may be placed on a removable shoe tag, or if the TMDE has a container, the label may be affixed to it.

b. The TMDE is used in an environment that might damage the labels (i.e., oil or fuels could destroy labels). Labels may be affixed away from the instruments. The process for positively identifying the instrument to the label shall be outlined in the PMEL quality manual.

c. On complex TMDE such as test stands or checkout consoles, certification labels for components may be grouped on the end-item.

NOTE

When a label is not affixed to its TMDE, there shall be some definite marking or annotation (preferably part number/serial number) on either the label or TMDE that links the two together. This requirement also applies to individual TMDE items that are part of a set or kit.

5.2.2 Removing Labels. Only authorized personnel shall remove labels when the item is being returned to supply. Prior to returning TMDE to supply, all labels shall be removed except the Bar Code Label. (Exception: At the depot TRC, Cesium Beam Standards designated ABSOLUTE and used for frequency only, may retain the certification label for items being shipped to a known customer.) The PMEL shall be notified the item has been turned in so they can remove it from their master inventory. Document the condition tags IAW T.O. 00-20-3.

5.3 BAR CODE LABELS. The PMEL shall ensure an original bar code label, AFTO Form 65 or 66, is initially affixed to each item of Air Force TMDE in the PMEL inventory. Ensure after cleaning TMDE surfaces that they are dry before applying these labels because wet solvent will remove the adhesive. Ensure there is at least one/eighth inch on both ends of the label beyond the bar code marks; this allows the bar code scanner to properly read the label. Preferred location for the bar code labels is on the upper right corner of the front panel. Damaged labels shall be replaced by a new AFTO Form 65 or 66 or an equivalent computer generated bar code using the original AFTO Form 65 or 66 bar code number. Computer generated bar codes are only authorized as a replacement.

5.3.1 AFTO Form 65 Aluminum Stock. This aluminum label, AFTO Form 65 (see Figure 5-2), is the preferred Bar Code Label due to its durability. However, there may be instances, due to safety or TMDE function, where the polyester AFTO Form 66 shall be used instead. See the instructions for the AFTO Form 66.

Figure 5-2.

AFTO FORM 65, BAR CODE LABEL, ALUMINUM STOCK

5.3.2 AFTO Form 66 Polyester Stock . Use of the polyester label, AFTO Form 66 (see Figure 5-3) is recommended, when using the aluminum AFTO Form 65 could be a safety hazard or prevent proper TMDE function or calibration.

Figure 5-3.

AFTO FORM 66, BAR CODE LABEL, POLYESTER STOCK

Examples include:

a. Small RADIAC dosimeters.

b. Small torque indicating devices.

c. TMDE that is inserted into mainframes or incorporated into other types of equipment where the label could become a conductive foreign object damage (FOD) hazard if it came loose.

d. TMDE used on a flightline or anywhere a dislodged label could be ingested into an aircraft engine.

5.4 CERTIFICATION LABELS.

5.4.1 General. All equipment that requires calibration shall have a certification label attached by the calibrating work center prior to use by the Owning Work Center (OWC). The one exception to this is when a non-Air Force source calibrated the TMDE. In this instance, the TMDE shall have both the non-AF certification label and an Air Force certification label with the additional required information affixed. The authority in this situation is "T.O. 00-20-14". Also, enter an annotation in the Air Force certification label special block, referencing the non-AF certification label or certificate, and any additional certification data associated with that calibration. When a certification label is affixed to TMDE, Air Force supply system condition tags, such as DD Forms 1574, Serviceable Label - Material, are not required unless the item is being returned to supply. Unless authorized, any changes to certification labels shall void the certification. Certification labels are not required for SICL end-item part numbers designated NEC that do not physically exist (e.g., the AN/APM-427)

5.4.2 Common Entry Instructions. The following requirements apply to all certification labels, unless otherwise indicated. For additional requirements see specific entries under the individual labels. For War Reserve Material (WRM) packages, see the specific instructions for the AFTO Form 108.

5.4.2.1 IDENTIFICATION NUMBER. Enter the OWC code, and the bar code number from the AFTO Form 65 or 66 if PMEL supported, or serial number if USER, of the equipment being certified. In addition, also enter WRM if the TMDE will be packed and stored as war readiness material. When the TMDE status is coded MOBILITY, you shall enter MOB to identify items for Mobility purposes. This block may be filled in by the TMDE user if an off base PMEL calibrates the TMDE, and the customer does not use the same database as the PMEL. Users may change the OWC code on a certification label. When this change is made, the user shall notify the PMEL.

5.4.2.2 AUTHORITY. This block applies to AFTO Forms 99 and 108 only. For those items with an AFTO Form 394 or 398 the T.O. listed in the PMEL master ID listing is the authority, if included; otherwise the authority is the T.O. listed in the applicable CMS, T.O. 33K-1-100-1or T.O. 33K-1-100-2.

5.4.2.2.1 Enter the calibration procedure identified in the CMS or T.O. 33K-1-100-2. Also enter the Computer Program Identification Number (CPIN), if it is used to perform part of the procedure and is not listed in the calibration procedure.

5.4.2.2.2 If there is no calibration procedure identified, either enter the DoD calibration procedure, the maintenance T.O. number, "COM DATA" (list the actual commercial data that was used in the SPECIAL block), or identify it as being calibrated by a non-AF source by entering "T.O. 00-20-14", as applicable. For See Individual Component Listing (SICL) end-items designated NEC, leave blank. For items designated NHA, enter "NHA". For items designated NCR that require a Special calibration, enter "T.O. 00-20-14" and list the procedure used in the special block.

5.4.2.2.3 Enter ABSOLUTE STANDARD in this block when applicable.

5.4.2.2.4 For TMDE calibrated with the ACS I or II enter ACS () plus the 5 digit unit access code (UAC) of the item tested. (Example: ACSI-WGGYR). Also, enter the 33K-procedure number if it is used to perform any part of the calibration manually. Abbreviations are acceptable.

5.4.2.3 SPECIAL. Enter any combination of the following as necessary. If there is insufficient space on the label for all entries, recommend affixing the label to a plain manila shoe tag. The rest of the limitations shall go on the manila tag. The certification label serves as the authority for the data written on the manila tag. The manila tag shall be attached to the TMDE item. A second alternative is to enter additional data on an AFTO Form 249 or equivalent when the plain manila tag interferes with use of the instrument. In either of these cases, reference the additional data in the special block of the certification label.

5.4.2.3.1 For SICL components, use this block to denote the component is "Part of" SICL end item part number (e.g., "Part of 12345-1"). If the component is calibrated as part of the end-item (generally designated NHA) and is not attached to the end-item or is to be removed from the end-item after calibration, also include the end-item bar code number or serial number.

5.4.2.3.2 For SICL end items, enter "SICL end item" in this block.

5.4.2.3.3 Indicate if there is additional calibration data. Specifically identify the additional data by a minimum of part number, bar code or serial number, calibration date, and initial or K stamp of certifying technician.

5.4.2.3.4 Identify why the item was fully or partially calibrated by the maintenance T.O. or commercial data, if not the authority listed in the CMS or T.O. 33K-1-100-2. If this was a result of an inadequacy in the calibration procedure, submit an AFTO Form 22 to correct the calibration T.O.

5.4.2.3.5 If the TMDE is not listed in a CMS or T.O. 33K-1-100-2 and was calibrated using one of the general calibration T.O.s listed in T.O. 33K-1-100-1 Section 3, enter the accuracy to which it was certified and the source data description (e.g., +/- 0.001 inch. See '*Manufacture*' catalog #29 pg 53, model 436.).

5.4.2.3.6 Make entries per para 5.4.1 if this was a contract calibration, which resulted in calibration meeting all specifications of Air Force or requirements.

5.4.2.3.7 If the calibration authority is COM DATA, list the actual commercial data and publication/revision date that was used.

5.4.2.4 CERTIFIED BY. The K stamp of the PMEL calibration technician, or the inspection/production stamp or initials of the calibration technician of other PWCs shall be entered in the block.

5.4.2.5 DATE CALIBRATED. Enter the date the TMDE was calibrated. Enter date as YYYYMMDD. When authorized to use manufacturer's certification, use date on manufacturer's certificate when provided, rather than date unit was received or placed into service. For an absolute standard, enter the date the certification label is completed. For SICL end item, complete if the SICL end item has a calibration interval. If there is no SICL end item calibration, enter NEC. The date calibrated may be post dated if one of the following cases apply:

a. The PMEL is authorized to post date the date calibrated to agree with the date that TMDE is picked up by or delivered to the customer at intervals less often than weekly.

b. The PMEL is authorized to post date the date calibrated to coincide with the deployment date for TMDE used to equip maintenance teams that are deployed to support off-base customers.

c. The PMEL is authorized to post date the date calibrated up to 30 days to coincide with the scheduled arrival date at the deployed location for TMDE with calibration intervals of 4 months or less that are deploying in support of Air Expeditionary Force (AEF) operations.

d. The AFPSL is authorized to post date the date calibrated to agree with a schedule or need date for special project TMDE being assembled for a PATEC, TFCU or RASCAL.

5.4.2.6 DATE DUE. Enter the date the equipment is due for calibration. Enter date as YYYYMMDD. For equipment coded MOBILITY enter the regular calibration due date. The equipment is overdue at the start of the following day. For example, an item due calibration on 13 June becomes overdue at 0001 hours, 14 June. Per paragraph 3.4.16 the date due may be extended up to one month when justified.

5.4.2.6.1 In cases where the calibration interval is based on both a specified interval and a number of operating hours, enter the date the item would be due for recalibration under the specified interval and the operation hours.

5.4.2.6.2 Enter ICO instead of a date, if applicable.

5.4.2.6.3 Leave this block blank if the TMDE will be packed or stored as WRM. Once the item is removed from the WRM package or storage, the user shall annotate their TMDE inventory listing and the certification label with the new due date. User shall also notify the PMEL of the new date due. The calibration due date shall be computed using the assigned calibration interval starting from the date the TMDE is removed from the WRM status.

5.4.3 AFTO FORM 108, TMDE CERTIFICATION LABEL. An AFTO Form 108 (see Figure 5-4) can only be used if all specifications of the calibration authority are met. The calibrating technician or other authorized person shall fill out this label as described in the general instructions or in the following manner, as applicable.

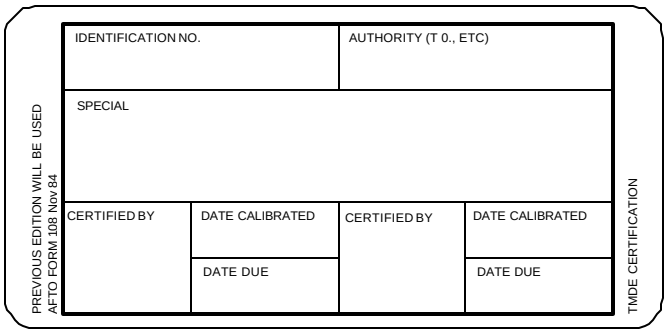

Figure 5-4.
AFTO FORM 108, TMDE CERTIFICATION LABEL (White)

5.4.3.1 Certification Labels for WRM Packages. An AFTO Form 108, TMDE Certification Label, shall be placed on the outside of containers which include TMDE packaged for storage as WRM. AFTO Forms 99/108/394/398 (as applicable) shall be used on individual items of TMDE packaged for WRM. The AFTO Form 108 blocks shall be completed as follows:

5.4.3.1.1 IDENTIFICATION NO. Enter the applicable weapon system with "WRM" after it (e.g., words F-15 WRM, F-16 WRM, etc).

5.4.3.1.2 AUTHORITY. Enter "T.O. 00-20-14".

5.4.3.1.3 SPECIAL. (Optional use - normally left blank).

5.4.3.1.4 CERTIFIED BY. Can contain the stamp of the PMEL technician. In lieu of this stamp, the MOB officer/NCO or the equipment custodian may initial this block. Certification pertains to the fact that the package contains WRM TMDE.

5.4.3.1.5 DATE CALIBRATED. Enter the date the container is packed.

5.4.3.1.6 DATE DUE. Enter the date that is 18 months after the earliest DATE CALIBRATED of any equipment in the package, irrespective of the assigned calibration interval of the individual equipment. For example, two items are being packed. One was calibrated 20001224 and one was calibrated 20001120. The calibration due date for the entire package is calculated 18 months from 20001120, the earliest date calibrated.

5.4.3.2 Certification Labels for SPRAMS. AFTO Forms 99/108/394/398 (as applicable) shall be used on individual TRUs for SPRAMS. The certificates shall be completed per the general instructions except as follows:

5.4.3.2.1 IDENTIFICATION NO. Also enter "SPRAMS".

5.4.3.2.2 SPECIAL. Enter the date the item is removed from SPRAMS.

5.4.3.2.3 DATE CALIBRATED. Enter the original calibration date.

5.4.3.2.4 DATE DUE. Leave this block blank. Once the item is removed from SPRAMS, the user shall enter the new due date or NHA then notify the scheduler of the new date due. The calibration due date shall be computed using the assigned calibration interval starting from the date the TMDE is removed from SPRAMS.

5.4.4 AFTO Form 394, TMDE Certification Label. AFTO Form 394 (see Figure 5-5) can only be used if all specifications of the calibration authority are met. The calibrating technician or other authorized person shall fill out this label as described in the general instructions.

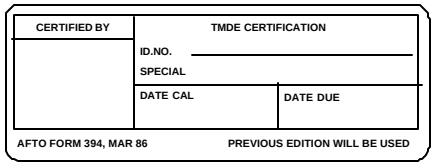

Figure 5-5.
AFTO FORM 394, TMDE CERTIFICATION LABEL

5.4.5 AFTO Form 99, Limited/Special TMDE Certification Label. The yellow AFTO Form 99 (see Figure 5-6) or the yellow AFTO Form 398 (see Figure 5-7) shall be affixed to standards and TMDE certified with a limited or special calibration as defined in Section 3 of this T.O. Also, certain 33K T.O.s may direct use of one of these labels because they do not verify all, or portions of, main functions and ranges. It is the responsibility of the user to read and apply whatever is in the SPECIAL block. These labels shall also be used for equipment designated as NHA, NPC or CBU. The calibrating technician or other authorized person shall fill out this label in the following manner and as described in the general instruction, as applicable.

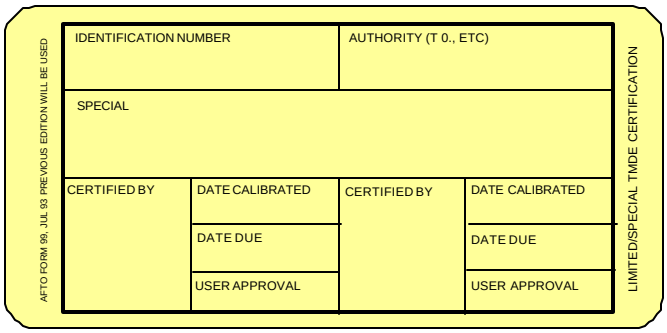

Figure 5-6.
AFTO FORM 99, LIMITED/SPECIAL TMDE CERTIFICATION LABEL (Yellow)

5.4.5.1 SPECIAL. In addition to the information listed in the General Entry Instruction in this Section, this block shall be used for the following purposes:

a. To indicate the accuracy to which the item was calibrated. If a 33K- or CMS is not available, the supporting PMEL shall compute the accuracy using the maintenance T.O. and/or commercial data.

b. To identify the basic function that was measured and the ranges or parameters certified (e.g., FUNCTION: 0-50 VAC). If it is more convenient, the exceptions may be entered (e.g., FUNCTION: Except 0-500V DC). In general cite the 33K Table 1 specification that is being limited (e.g., VDC, VAC, etc.)

c. To identify special accuracy, ranges, points calibrated, or other information of value to user.

5.4.5.2 DATE CALIBRATED. Enter date calibrated, NHA or leave blank as applicable.

5.4.5.3 DATE DUE. Enter date due, NHA, NPC, date due/CBU, or leave blank as applicable.

5.4.5.4 USER APPROVAL. The supervisor of the user organization or the designated representative shall sign or initial this block to indicate that the user agrees with the limited or special calibration performed.

5.4.6 AFTO FORM 398, LIMITED TMDE CERTIFICATION LABEL. The yellow AFTO Form 398 (see Figure 5-7) or the yellow AFTO Form 99 (see Figure 5-6) shall be affixed to standards and TMDE certified with a limited or special calibration as defined in Section 3 of this T.O. Also, certain 33K T.O.s may direct use of one of these labels because they do not verify all, or portions of, main functions and ranges. It is the responsibility of the user to read and apply whatever is in the SPECIAL block. These labels shall also be used for equipment designated as NHA, NPC and CBU. The calibrating technician or other authorized person shall fill out this label in the following manner and as described in the general instruction, as applicable.

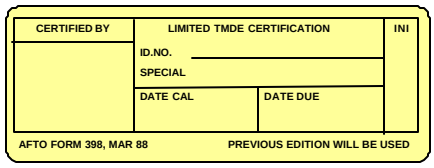

Figure 5-7.
AFTO FORM 398, LIMITED TMDE CERTIFICATION LABEL (Yellow)

5.4.6.1 SPECIAL. This block shall contain specific limitations or special calibration data. It will normally be used to direct the reader to see an AFTO Form 249 or other data sheet, since it is unlikely that all the instrument limitations (or special data) can be documented on the AFTO Form 398.

5.4.6.2 DATE CAL. Enter date calibrated, NHA or leave blank as applicable.

5.4.6.3 DATE DUE. Enter date due, NHA, NPC, date due/CBU as applicable.

5.4.6.4 INI. The supervisor of the user organization or the designated representative shall initial this block to indicate that the user agrees with the limited or special calibration performed by the PMEL. Note: On versions of this label, without an INI block, initial in the label border adjacent to the Date Due block.

5.5 AFTO FORM 256, NO CALIBRATION REQUIRED. The AFTO Form 256 (see Figure 5-8) shall be affixed to those items of TMDE listed as NCR in a CMS or T.O. 33K-1-100-2.

Figure 5-8.
AFTO FORM 256 NO CALIBRATION REQUIRED LABEL

5.5.1 Affixing and Validation Responsibility. Organizations that possess NCR TMDE are responsible for affixing and validating the AFTO Form 256 for these items.

5.5.2 Validation. This label shall be validated with a PMEL K stamp, or the inspection/ production stamp or initials of the user of the TMDE

5.5.3 PMEL NCR TMDE. On NCR TMDE designated PMEL or AFPSL responsibility in the CMS or T.O. 33K-1-100-2, annotate the OWC and bar code label number (if assigned) on the AFTO Form 256.

5.5.4 Small NCR TMDE. On NCR TMDE too small to affix the label, a white dot can be used in place of the AFTO Form 256.

5.6 NIST REPORT OF MEASUREMENT. This report is completed by NIST on all Air Force measurement standards calibrated by NIST. A copy of the report shall remain with the standard.

5.7 CALIBRATION CERTIFICATES OR CALIBRATION REPORTS.

5.7.1 AFPSL Calibration Certificate or Report. The AFPSL completes this certificate or report when a formal certificate/report is required or requested for base measurement standards, Air Force measurement standards, and TMDE. When issued, the certificate or report shall contain the required information in paragraph 5.7.3.

5.7.2 PMEL Calibration Certificate or Report. A certificate or report completed by the PMEL when requested by a user or as directed by the calibration T.O. or other directive. When issued, the certificate or report shall contain the required information in paragraph 5.7.3.

5.7.3 Calibration Certificate and Report Format. The format of the certificate or report shall be specifically designed for each type of calibration, but the headings shall be standardized and include all information necessary for the interpretation of the calibration results. Each calibration certificate or report shall be accurate, clear, unambiguous, and objective, in accordance with any instructions in the calibration authority. Where the certificate or report contains results of calibrations performed by other than the PMEL, these results shall be clearly identified. When issued, the certificate or report shall contain , as a minimum:

a. Title, e.g., "Calibration Report" or "Calibration Certificate."

b. Name and address of PMEL, and location where calibration was performed, if different from the PMEL.

c. Unique identification of the report (such as serial number), and on each page the page number and total number of pages (e.g., Page 3 of 5).

d. Name and address of customer, where appropriate.

e. Description of the item calibrated, including model and serial number.

f. Condition of the calibrated item.

g. Date(s) calibrated. (YYYYMMDD)

h. Identification of the calibration procedure used or a clear description of any nonstandard method used.

i. Reference to sampling procedure, where relevant.

j. Any deviation from, additions to, or exclusions from the calibration method, and any other information relevant to a specific calibration, such as environmental conditions.

k. Measurements, examinations and derived results, supported by tables, graphs, sketches and photographs, as appropriate, and any failures identified.

l. A statement of estimated uncertainty of the calibration result. This requirement applies to the AFPSL and field PMELs where the customer can provide written proof of their requirement for this data. PMELs with a documented requirement shall contact AFMETCAL Det 1 for assistance.

m. For TMDE found out-of-tolerance during the calibration/verification process, measurement data shall be reported to the customer so that appropriate action can be taken.

n. A signature, title, or an equivalent identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and the date of issue.

o. Where relevant, a statement that the results relate only to the items calibrated.

p. A statement that the certificate or report shall not be reproduced except in full, without the written approval of the issuing laboratory.

q. Special limitations of use (e.g., Interpolation of data is/is not authorized).

5.7.4 Calibration Certificate or Report Amendments. Amendments to the calibration certificate or report after issue shall be made in the form of a separate document including the statement, "Supplement to Calibration Report (or calibration certificate)" and shall include the identifying number of the original report or certificate. Supplements shall meet all the requirements of original reports or certificates.

5.7.4.1 Amendments are required for any event such as the identification of defective calibration equipment, that casts doubt on the validity of results given in any calibration report, certificate, or amendment. Such amendments shall quantify the magnitude of error in the calibration results.

5.7.5 Calibration Certificate or Report Confidentiality. The issuing laboratory staff shall follow documented procedures ensuring confidentiality is preserved where customers require transmission of calibration results by telephone, telex, facsimile, or other electronic means.

TMDE CALIBRATION DATA

1. NOMENCLATURE	2. MODEL	3. SERIAL NUMBER
4. CALIBRATED BY	5. ENVIRONMENTAL DATA	6. CALIBRATION PROCEDURE / 7. DATE

CALIBRATION FUNCTION	ACCURACY	STANDARD READING	TEST INSTRUMENT READING	ERROR

AFTO FORM 249, JAN 96 (EF-V1) (PerFORM PRO) PREVIOUS EDITION IS OBSOLETE

Figure 5-9.
AFTO FORM 249, TMDE CALIBRATION DATA

5.8 AFTO FORM 249, TMDE CALIBRATION DATA. The AFTO Form 249 (see Figure 5-9) may be completed for TMDE certified at other than the full range, or if necessary, to show the actual values of the parameters certified. The PMEL or other calibrating workcenter may retain a duplicate copy for records. The form shall be used only in conjunction with Air Force certification labels. The AFTO Form 249 shall be completed in the following manner:

a. Block 1, NOMENCLATURE. Enter the nomenclature of the item.

b. Block 2, MODEL. Enter the type and/or model designation of the equipment.

c. Block 3, SERIAL NUMBER. Enter the serial number of the item.

d. Block 4, CALIBRATED BY. Enter either the name or the K stamp of the technician completing the calibration.

e. Block 5, ENVIRONMENTAL DATA. Enter N/A except in those cases when a specific environment condition is specified in the T.O. In that case, enter the specified condition, such as 25°C.

f. Block 6, CALIBRATION PROCEDURE. Enter the technical data reference containing the calibration procedures used.

g. Block 7, DATE. Enter the date the item was calibrated. (YYYYMMDD)

h. CALIBRATION FUNCTION. Enter the specific range, function, or calibration point of the instrument being calibrated.

i. ACCURACY. Can be used to identify the accuracy of the reading.

j. STANDARD READING. Enter the reading obtained from the standard.

k. TEST INSTRUMENT READING. Enter the reading obtained from the instrument being calibrated.

l. ERROR. Calculate the difference between the standard reading and the test instrument reading, using the plus sign (+) or minus sign (-) to indicate high or low test instrument readings respectively.

5.9 AFTO FORM 250, TMDE CALIBRATION CORRECTION CHART. The AFTO Form 250 (see Figure 5-10) shall be completed when requested by the using organization or to show the correction that must be applied to the indicated reading to obtain the actual value. It shall be used only in conjunction with an Air Force certification label. The form shall accompany the item whenever possible. The AFTO Form 250 shall be completed in the following manner:

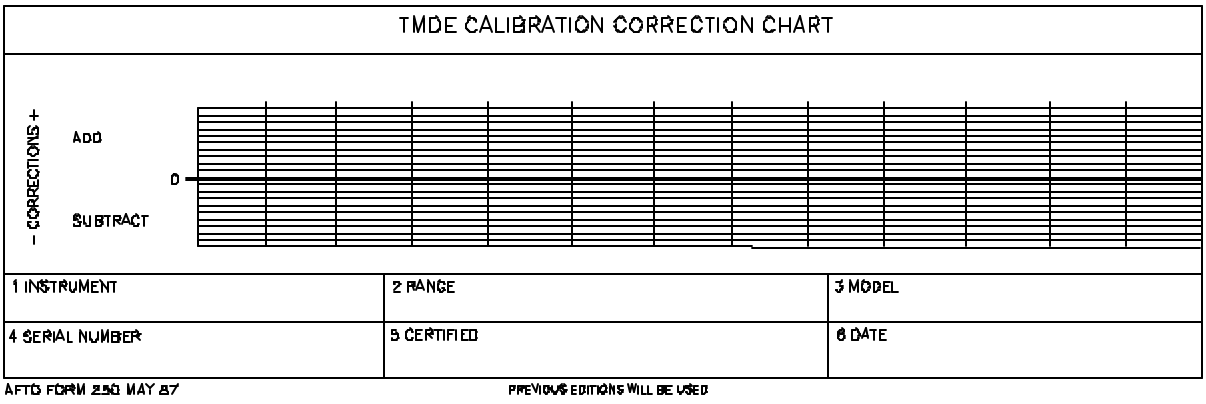

Figure 5-10.
AFTO FORM 250, TMDE CALIBRATION CORRECTION CHART

a. Block 1 INSTRUMENT. Enter the nomenclature of the affected item.

b. Block 2, RANGE. Enter the range in which the function is measured. Indicate the cardinal points of the range to be certified in equal segments along the horizontal axis of the graph.

c. Block 3, MODEL. Enter the type and/or model designation of the item.

d. Block 4, SERIAL NUMBER. Enter the serial number and the Bar Code Number of the item.

e. Block 5, CERTIFIED. Enter the name or K stamp of the technician completing the calibration.

f. Block 6, DATE. Enter the date the item was calibrated. (YYYYMMDD)

g. – CORRECTIONS +. Under ADD and SUBTRACT, enter the rating or tolerance expressed in a specific value of the range being calibrated. Use the horizontal center line (0) to correspond to the settings of the calibrating standard. At each cardinal point previously entered on the horizontal axis, indicate the test instrument readings at points above or below the centerline, as required. This shall show the exact value to be added or subtracted to make test instrument readings equal to those of the calibrating standard. Connect the indicating points along the horizontal axis to complete the correction curve.

5.10 MEASUREMENT STANDARD DECALS. Equipment that is certified as an Air Force Measurement Standard or a Base Measurement Standard shall be identified with the appropriate decal established for this purpose. T.O. 33K-1-101-CD-1 identifies Base Measurement Standards.

5.10.1 Gold Decal. The gold Air Force Measurement Standard Decal and a certification label shall be affixed to standards possessed and used by the AFPSL as a basic measurement standard for the Air Force.

5.10.2 Blue Decal. The blue Base Measurement Standard Decal and a certification label shall be affixed to standards that are possessed and used by a PMEL as a Base Measurement Standard. PMEL personnel that certify or possess the standard shall affix the decal. The base measurement standard decal shall not be affixed to working standards calibrated by the possessing PMEL. The blue decals may be obtained from the AFPSL.

5.11 AFTO FORM 255, NOTICE CERTIFICATION VOID WHEN SEAL IS BROKEN. The AFTO Form 255 (see Figure 5-11) label or an alternate method listed below shall be applied to operator accessible controls or adjustments on standards and other TMDE, which if moved, will invalidate the calibration. If a panel must be removed to access controls or adjustments, they are not considered operator accessible. Apply this label sparingly and reserve for critical locations or TMDE susceptible to tampering. If label is broken or shows signs of tampering, the certification is void. Equipment shall be scheduled for certification unless situations addressed in exceptions paragraph apply. This label shall be validated with a K stamp of PMEL technician. Any non-PMEL organization applying the label can use inspection or production stamp or the initials of the responsible certifying technician. Do not cover the face of this label with any kind of tape that would defeat the purpose of the label. Alternate methods, such as sealant, may be used at the option of the responsible calibrating work center to seal TMDE if the AFTO Form 255 cannot be applied satisfactorily.

Figure 5-11.
AFTO FORM 255, NOTICE CERTIFICATION VOID WHEN SEAL IS BROKEN LABEL

5.11.1 Exceptions If the seal is broken accidentally, or to perform organizational maintenance such as cleaning or replacing fuses, pilot lights, batteries, or other minor hardware items, an identification tag such as an AFTO Form 350 shall be attached noting the reason, date, and OWC supervisor's signature. Recertification shall not be accomplished if calibration accuracy is not in question.

REQUEST FOR CALIBRATION RESPONSIBILITY DETERMINATION | *OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 6 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, DIOR, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302: and to OMB, Paperwork Reduction Project (0704-0188), Washington DC 20503. Please DO NOT RETURN your form to either of these addresses. Send your completed form to AFMETCAL DET 1/MLSP, 813 Irving-Wick Dr W, Heath Ohio 43056-6116

PMEL PORTION — (*) **MANDATORY**

MODEL/PART NUMBER/TYPE *	MANUFACTURER *	SERIAL NUMBER *
NOMENCLATURE *		APPLICABLE MAINTENANCE MANUAL
NATIONAL STOCK NUMBER	QUANTITY	WEAPON SYS(s) OR END ITEM SUPPORTED *	ALLOWANCE SOURCE CODE: *
LOCAL PURCHASE * ☐ YES ☐ NO	WORK STOPPAGE ☐ YES	ITEM ON HAND ☐ YES	PROJECTED CAL DUE DATE _____ (MO/YR)
SUPPORTING PMEL/PHONE: * - ADDRESS: * - - BASE: * - COMMAND: *		USER NAME / PHONE: * - EMAIL: * - OWC/ Agency: * - CMD/ ORG: * - Base/ City: *	
NAME/ PHONE/ EMAIL OF REQUESTING INDIVIDUAL: *		SUPPORTING DATA SUBMITTED * ☐ YES ☐ NO	

REMARKS

MAIL TO: **AFMETCAL DET1 / MLSP, 813 Irving-Wick Dr W, Heath Ohio 43056-6116** | REQUEST DATE *

AFMETCAL DET 1 PORTION

ML CONTROL NUMBER	OPR ORG ML	OPR NAME: - PHONE: - EMAIL:	DATE RECEIVED
RESPONSIBILITY DETERMINATION ☐ IS _____	☐ CANNOT BE MADE DUE TO INSUFFICIENT TECHNICAL INFORMATION. A DETERMINATION WILL BE MADE IF YOU SUBMIT THE NEEDED INFORMATION. See REMARKS.		NEW PROCEDURE REQUIRED ☐ YES ☐ NO

WUC IS	CALIBRATION INTERVAL IS	CALIBRATION AUTHORITY IS	MAINTENANCE MANUAL IS

REMARKS

ITEM ☐ WILL BE ☐ WILL NOT BE ☐ ALREADY IS ☐ LISTED IN T.O. 33K1-100 ☐ LISTED IN CMS: _____

NON-TMDE ☐ ITEM IS NOT TMDE ACCORDING TO DEFINITION IN T.O. 00-20-14, DOES NOT REQUIRE CALIBRATION, AND IS **'USER'** RESPONSIBILITY

SUPERVISOR | RESPONSE DATE

AFTO FORM 45, *YYYYMMDD* **(EF-V1)** **PREVIOUS EDITION IS OBSOLETE**

Figure 5-12
AFTO FORM 45, REQUEST FOR CALIBRATION RESPONSIBILITY DETERMINATION

5.12 AFTO FORM 45, REQUEST FOR CALIBRATION RESPONSIBILITY DETERMINATION .

NOTE

Ensure Requests for Calibration Responsibility Determination, AFTO Form 45 (see Figure 5-12), are **not** submitted for equipment owned and used by departments outside the Air Force. Such a customer is responsible to give the PMEL the capability to support new equipment, if the PMEL does not already have it.

The PMEL, with the assistance of the user of new TMDE, shall initiate the Request for Calibration Responsibility Determination, AFTO Form 45 (see Figure 5-12), to ensure that the AFMETCAL Program can support the particular item of TMDE. This information is required to enable the PMELs, AFMETCAL Det 1, and the inventory managers to obtain support equipment and write any calibration procedures for calibration and maintenance of the item. If inadequate data are submitted with the form and determination of responsibility cannot be made, the request shall be returned. Many TMDE items also have accessories that require calibration. When submitting requests for calibration determinations, include data on any accessories that require calibration so they can be included in the calibration procedure. The initiating PMEL shall complete the top portion of the form and forward the form to AFMETCAL Det 1/MLLW. The PMEL retains a copy. AFMETCAL Det 1 shall complete the form, retain one copy, and return a copy to the PMEL. Blocks marked with an asterisk (*) are mandatory and shall be completed.

5.12.1 PMEL PORTION. The blocks in the request portion of the form shall be completed by the PMEL, with the assistance and coordination of the user (see AFMAN 23-110), in the following manner:

a. MODEL/PART NUMBER/TYPE. (Mandatory) Enter the manufacturer's model designation, part number, or similar data. Provide all data available.

b. MANUFACTURER. (Mandatory) Enter the name of the manufacturer of the item.

c. SERIAL NUMBER. (Mandatory) Enter the serial number of the item.

d. NOMENCLATURE. (Mandatory) Enter nomenclature of item.

e. APPLICABLE MAINTENANCE MANUAL. Identify the maintenance T.O. that applies to the unit.

f. NATIONAL STOCK NO. Enter the national stock number of the item. If not available, enter date stock number was requested.

g. QUANTITY. Enter the quantity to be supported by the PMEL, if known.

h. WEAPON SYSTEM(s) OR END ITEM SUPPORTED. (Mandatory) Identify the system or end item being supported. (e.g., F-16C, or AN/ALQ-131V3)

i. ALLOWANCE SOURCE CODE. (Mandatory) Enter the allowance source code (ASC) corresponding to system or item supported that was used to obtain this item. If none, explain in Remarks.

j. LOCAL PURCHASE. (Mandatory) Check the applicable block for items locally purchased. The user is responsible for providing the PMEL any items required for maintenance and calibration of any item locally purchased. Before buying any items locally, the potential owner shall contact the PMEL to determine if PMEL support will require any additional equipment, supplies, or data. See user responsibilities in Section 3.

k. WORK STOPPAGE. Check if this refers to work stoppage due to a lack of this item, not the inability to calibrate this item.

l. ITEM ON HAND. Check if the item is on hand in the PMEL or is available on call. Use the PROJECTED CAL DUE DATE to inform AFMETCAL Det 1 of the month and year the calibration procedure will be needed.

m. PROJECTED CAL DUE DATE. Enter the projected date the item is expected to require calibration again.

n. SUPPORTING PMEL / PHONE. (Mandatory) Enter the name, phone, address, and command of the PMEL submitting the request

o. USER NAME / PHONE. (Mandatory) Enter the user's point of contact name, phone, and email. Also enter the owning workcenter code, agency, command, organization, base and city.

p. NAME / PHONE / EMAIL OF REQUESTING INDIVIDUAL. Enter name, Defense Switched Network (DSN) or commercial telephone number, and email address of PMEL point of contact in case further data is necessary.

q. SUPPORTING DATA SUBMITTED. (Mandatory) Check the appropriate block. Identify specific items of commercial data submitted along with this form in the Remarks block. If you reference a website, provide the site address. AFMETCAL Det 1/MLLW needs all available data to make the responsibility determination. It is also needed to write an adequate calibration procedure if the request results in a determination that the PMEL is responsible for calibration and repair of the item. If not enough data is submitted, a calibration responsibility determination cannot be made and the request shall be returned without a final determination. AFMETCAL Det 1 shall ensure that all data are returned to the PMEL/user as soon as possible. Explain in Remarks if you check 'NO'.

r. REMARKS. One type of comment to include here is a calibration responsibility determination that the PMEL or user would recommend and why it is recommended. It is requested that all reasons for the recommendations be specified since the PMEL is in a better position to know who can best support the item. Remarks regarding the actual measurement to be made, the owning organization, its capability to support the item, and what system the equipment is to be used on. It can also be used for other comments the PMEL thinks may help the evaluator in their determination. Include applicable work unit code(s) (WUC) whenever they exist for that part number.

s. DATE. Enter the date of the request.

5.12.2 AFMETCAL DET 1 PORTION. AFMETCAL Det 1 personnel shall complete the following blocks:

a. ML CONTROL NUMBER. Enter the applicable control number.

b. OPR ORG. Enter the organizational symbol for the AFMETCAL Det 1 office that shall serve as OPR for this request.

c. OPR NAME. Enter the name, DSN or commercial telephone numbers, and email address of the person that shall be OPR for this request.

d. DATE RECEIVED. The office identified above received date.

e. RESPONSIBILITY DETERMINATION. Check the appropriate block or fill in the responsibility determination.

f. NEW PROCEDURE REQUIRED. Check the appropriate block.

g. WUC IS. Enter the assigned WUC.

h. CALIBRATION INTERVAL IS. Enter the initial calibration interval for this part number or model.

i. CALIBRATION AUTHORITY IS. Enter the calibration authority if calibrated.

j. MAINTENANCE TO NUMBER. Enter one, if one exists. It may provide useful data.

k. REMARKS. This block is used to explain rationale behind the entry in one of the previous two blocks. Give specific reasons why a determination cannot be made or explain why a specific determination was made.

l. ITEM. Check appropriate blocks.

m. NON-TMDE. Check if item is not TMDE according to definition in T.O. 00-20-14 and is not PMEL responsibility. If this block is checked, the item under consideration is the responsibility of the USER for support.

n. SUPERVISOR. Written name of supervisor of person called out above.

o. RESPONSE DATE. Enter the date the calibration responsibility determination is made.

PMEL TECHNICAL ORDER INFORMATION

1. MAINTENANCE TECHNICAL ORDER INFORMATION

A. PART NUMBER	B. MAINTENANCE TECHNICAL ORDER	A. PART NUMBER	B. MAINTENANCE TECHNICAL ORDER

2. ADDITIONAL ITEMS REQUIRED FROM THE OWNING WORK

3. LOCATION OF TEST FIXTURES	4. SUITABLE SUBSTITUTES FOR STANDARDS REQUIRED IN CALIBRATION PROCEDURES	
	A. TMDE CALLED FOR	B. SUBSTITUTE ITEM
5. AFTO FORM 22 INFORMATION		

6. ALTERNATE PROCEDURE INFORMATION	7. PECULIARITIES OF TMDE OR CALIBRATION PROCEDURE

8. HIGH FAILURE COMPONENTS

A. PART NUMBER	B. NOMENCLATURE	C. NATIONAL STOCK NUMBER

AFTO FORM 57, 19960301 *(EF-V2)*

Figure 5-13.
AFTO FORM 57, PMEL TECHNICAL ORDER INFORMATION

5.13 AFTO FORM 57, PMEL TECHNICAL ORDER INFORMATION. The AFTO Form 57 (see Figure 5-13) is for the PMEL to record data relative to a calibration procedure that pertains to their peculiar situation. It shall be filed in the folder holding the pertinent calibration T.O. This form is not required with each T.O. It is to be completed to the degree (and when) PMEL personnel feel is necessary or as needed. Also, it shall not be used in place of AFTO Form 22 action. Local reproduction of this form is authorized. The following guidance is provided for entries on this form:

NOTE

The technician shall verify information entered on the AFTO Form 57 prior to using such information .

a. Block 1, MAINTENANCE T.O. INFORMATION. Enter the part number and maintenance T.O. for the different models or part numbers covered by the procedure in the appropriate blocks.

b. Block 2, ADDITIONAL ITEMS REQUIRED FROM THE OWC. Enter any additional ancillary items or equipment that must be supplied by the OWC to facilitate repair or calibration of the TMDE entered in Block 1.

c. Block 3, LOCATION OF TEST FIXTURES. Enter the PMEL storage location of test fixtures required for repair or calibration of the TMDE entered in Block 1.

d. Block 4, SUITABLE SUBSTITUTES FOR STANDARDS REQUIRED IN CALIBRATION PROCEDURES. Enter the part number of all TMDE listed in the procedure that is not locally available and the part number of the substitute standard in the appropriate blocks.

NOTE

Ensure required accuracy ratios are maintained when substituting standards during calibration.

e. Block 5, AFTO FORM 22 INFORMATION. Enter all AFTO Form 22 information as necessary to identify deficiencies in the procedure. Enter date submitted, paragraph affected, and name of technician submitting the AFTO Form 22 as a minimum.

NOTE

Approval of an AFTO Form 22 is not justification to deviate from published technical data IAW T.O. 00-5-1.

f. Block 6, ALTERNATE PROCEDURE INFORMATION. Enter any information that shall allow the technician to locate or perform approved alternate procedures.

g. Block 7, PECULIARITIES OF TMDE OR CALIBRATION PROCEDURE. Enter any information that will assist the technician during calibration of the TMDE.

h. Block 8, HIGH FAILURE COMPONENTS. Enter any components that are considered high failure items or components that are difficult to identify (Part Number and NSN) in the appropriate blocks.

5.13.1 Continuation Sheets. Continuation sheets can be attached as necessary.

5.14 AF FORM 537, PMEL SHIPPING LABEL.

The AF Form 537 (not pictured) shall be used as prescribed when TMDE is shipped from one PMEL to another for calibration/repair and return.

SECTION 6

PMEL REPORTS: RCS HAF-ILM(SA) 7808 and RCS HAF-ILM(A) 9450

6.1 PMEL REPORT, RCS: HAF-ILM(SA) 7808. The PMEL Report, RCS: HAF-ILM(SA) 7808, semiannual report has been established to provide information to AFMETCAL Det 1 and USAF/ILMM to aid in the management of the AFMETCAL Program and to perform special studies. The major commands use the report for the management of their respective PMEL programs. AFMETCAL Det 1 uses this information to produce a semi-annual Data Summary PMEL Report. The '7808' report is also used to generate a self-sufficiency listing for each PMEL and provides a detailed listing of the items that each PMEL cannot do themselves.

6.1.1 Date Report to be completed. The report shall be completed as of 30 June and 31 December each year at those Air Force activities operating authorized PMELs listed in paragraph 10.3.

6.1.2 Date Report to be submitted. The report shall be submitted to AFMETCAL Det 1 to arrive by the 31st day of July and January. The report shall be accomplished using the AFTO Form 80, (Figure 6-1) or the PAMS generated form when that program is implemented. The report may be submitted on plain bond paper for contractor operated PMELs. Local reproduction is authorized. Locally reproduce AFTO Form 80 on 8 1/2 X 11 paper as shown in Figure 6-1.

6.1.3 No Classified Information. The report shall not contain classified information. When it is necessary to submit classified information, it shall be submitted by separate correspondence and cross-referenced to the applicable section of the AFTO Form 80.

6.1.4 Preparation of AFTO Form 80. The AFTO Form 80 shall be prepared in the following manner.

6.1.4.1 Addressees and Date:

a. TO. For the original and one copy, enter AFMETCAL Det 1, 813 Irving-Wick Dr W, Ste 4M, Heath, Ohio 43056-6116. For other copies, enter addresses as directed by the major command. Ensure that one copy is forwarded to the PMEL Functional Area Manager for your command.

b. AS OF DATE. Enter 30 June or 31 December as applicable.

6.1.4.2 Section I, WORKING ACTIVITY:

a. Block 1, MAJOR AND INTER COMMAND. Enter the major command and numbered Air Force (or comparable command) designation having jurisdiction over the PMEL.

b. Block 2, BASE. Enter the name of the Air Force base or Air Force station on which the PMEL is located. If the PMEL is not located at an Air Force base or station, the physical location of the PMEL shall be entered.

c. Block 3, UNIT. Enter the Air Force designation of the organization operating the PMEL. This, combined with the block 4, ORGN SYMBOL, entry is the official mailing address for correspondence with the PMEL.

d. Block 4, ORGANIZATION SYMBOL. Enter the administrative office symbol assigned to the PMEL for mailing purposes. Also enter the PWC code(s) for the PMEL. If the OWC is different from the PWC, enter it/them.

e. Block 5, DSN. Enter the base telephone number in the defense switched network system. Include extension if applicable.

f. Block 6, COMMERCIAL PHONE. Enter the base telephone number in the commercial telephone system to include area/country code, as applicable.

g. Block 7, EXTENSION. Enter the extension(s) at which the PMEL superintendent can be reached.

h. Block 8, PMEL BUILDING NUMBER. Enter the building number in which the PMEL is located.

i. Block 9, DATE OF LAST PMEL EVALUATION. Enter the date of the last formal evaluation visit performed by AFMETCAL Det 1 under the provisions of Section 7 of this T.O.

j. Block 10, CERTIFICATE DATE. Enter the date of the certificate. If no certificate has been issued, enter No Certificate.

k. Block 11, PMEL SUPERINTENDENT NAME & RANK (*Typed*). Enter the TYPED name and military grade, when applicable, of the person directly responsible for the PMEL operations.

l. Block 12, PMEL SUPERINTENDENT'S SIGNATURE. The PMEL Superintendent shall sign in this block.

6.1.4.3 Section II, WORKLOAD:

a. Block 13, TMDE INVENTORY SUPPORTED FOR. Enter the number of items of TMDE the reporting activity is required to support in the categories shown. This shall not include TMDE that has never been in or supported by the PMEL. This shall be the items listed in the inventory of the PMEL. This shall include TMDE designated as NCR (no calibration required) for which the PMEL has only repair responsibilities. Exclude items sent to the depot or some other PMEL. For the purposes of this report, the categories are defined as follows:

(1) AF. Activities of the Air Force and Air Force Reserve units on active duty. Government furnished equipment (GFE) used in contracted PMELs shall be included in this category.

(2) ANG. Organizations of the Air National Guard.

(3) AFRC. Air Force Reserve units not on active duty.

(4) ARMY. Army and Army National Guard Organizations.

(5) NAVY. Navy and Marine Corp organizations and reserve units.

(6) COAST GUARD. Coast Guard organizations and stations.

(7) CONTR. TMDE supported for contractors with a DOD contractual obligation. This does not include GFE in the contractor operated PMELs. This includes both government furnished and contractor's equipment when the contractor is a PMEL customer.

(8) OTHER. All TMDE supported for activities or organizations not included in the foregoing categories. For example: DOD, NASA, FAA, and Security Assistance Program participating countries.

b. Block 14, TOTAL. Enter the total number of items entered in the Block 13 categories.

c. Block 15, TMDE INVENTORY ANALYSIS. Enter the total number of items in categories shown as extracted from Master ID listing.

d. Block 16, WORKLOAD ANALYSIS ACTION TAKEN (*Past six months*). Enter, for the six-month period covered by the report, the number of completed actions recorded under action taken codes F, G, J, K, and other and the total completed actions for all action taken codes. Do not include actions taken with zero (0) unit count. Refer to T.O. 33K-1-100-1, Section 2, for in-depth definitions of action taken codes.

(1) Code F. Repair. Use this code when repair and calibration is required.

(2) Code G. Repair and/or replacement of minor parts. Use this code when calibration is not required as a result of minor repair.

(3) Code J. Calibrated - No major adjustment required. Item is calibrated and found serviceable without need for adjustment, or is found to be in tolerance but is adjusted merely to peak or maximize the reading, or the item is in tolerance but the adjustment is required in the procedure.

(4) Code K. Calibrated - Adjustment required. Use this code when adjustment(s) were required to return TMDE parameters to T.O. specifications.

(5) OTHER. The total of all other actions (codes A, B, C, D, X, 0 through 9, and so forth).

(6) TOTAL. The total of all actions listed above.

PRECISION MEASUREMENT EQUIPMENT LABORATORY REPORT

OMB No. 0704-0188

REPORTS CONTROL SYMBOL RCS:

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TO	AS OF DATE

I. WORKING ACTIVITY

1. MAJOR AND INTER COMMAND	2. BASE	3. UNIT	4. ORGANIZATION SYMBOL
5. DSN	**6. COMMERCIAL PHONE**	**7. EXTENSION**	**8. PMEL BUILDING NUMBER**
9. DATE OF LAST PMEL EVALUATION		**10. CERTIFICATION DATE**	
11. PMEL SUPERINTENDENT'S NAME AND RANK (*Typed*)		**12. PMEL SUPERINTENDENT'S SIGNATURE**	

II. WORKLOAD

13. TMDE INVENTORY SUPPORTED FOR

AF	ANG	AFRES	ARMY	NAVY	COAST GUARD	CONTR	OTHER	14. TOTAL

15. TMDE INVENTORY ANALYSIS

SCHEDULED		UNSCHEDULED					
PMEL	DEPOT	NCR	NPCR	CBU	STORAGE	OTHER	TOTAL

16. WORKLOAD ANALYSIS ACTION TAKEN (*Past six months*)

ACTION TAKEN	F	G	J	K	OTHER	TOTAL

17. ACTIVITIES SUPPORTED / QUANTITY SUPPORTED

UNIT DESIGNATION	MAJCOM AGENCY	LOCATION	PMEL	DEPOT	TFCU	ONSITE	MOB	WRM
PMEL OWNED								

III. PERSONNEL

18. MILITARY				19. CIVILIAN			
CAFSC	UDL AUTH	PMEL ASGD	ASGD FROM MAINT	SERIES AND GRADE	UDL AUTH	PMEL ASGD	ASGD FROM MAINT
2P001							
2P091							
2P071							
2P051							
2P031							
OTHER							
TOTAL							

20. NUMBER ASSIGNED PERFORMING DIRECT LABOR (*Technicians*)

IV. FACILITIES

SPACE AVAILABLE (*Sq Ft*)
TOTAL PMEL (*Gross Space*)
CALIBRATION/REPAIR AREA
OFFICE AREA
RECEIVING/ISSUE/STORAGE AREA
TRAINING/TECH LIB/BREAK AREA
CLEANING ROOM
OTHER

V. SELF SUFFICIENCY

ATTACH A LIST OF ITEMS SENT TO SOME OTHER AGENCY FOR CALIBRATION

AFTO FORM 80, JAN 97 (*EF-V1*) (*PerFORM PRO*) **PREVIOUS EDITION IS OBSOLETE**

Figure 6-1.
AFTO FORM 80, PRECISION MEASUREMENT LABORATORY REPORT

e. Block 17, ACTIVITIES SUPPORTED QUANTITY SUPPORTED. Provide a complete list of customers supported. The first line shall contain quantities owned by the PMEL. Use a continuation sheet, if necessary.

(1) UNIT DESIGNATION. Enter the official military designation of the Air Force activity supported; e.g., 301 FW, 2048 COMM, etc. Identify non-Air Force activities supported by the name and organization designation shown on the interservice support agreement (ISA) or other official designation if an ISA has not been negotiated; e.g., US Weather Bureau, HQ14 Marines, etc.

(2) MAJCOM AGENCY. Enter the abbreviation of the major command of Air Force activities supported; e.g., ACC, AMC, USAFE, etc. Enter the name or abbreviation of the parent agency of non-Air Force activities supported; e.g., Army, DMA, FAA, contractor, etc.

(3) LOCATION. Enter the location of the activity supported; e.g., Carswell AFB TX; Ceggia, Italy, etc.

(4) PMEL. Enter the quantity supported by and accomplished in the reporting PMEL for each activity identified in the UNIT DESIGNATION column. Do not duplicate the quantity shown in the TFCU and ON-SITE columns.

(5) DEPOT. Enter the quantity supported by other sources such as a technical repair center, air logistic center PMEL, other off-base PMEL, contractor (other than laboratory contractor, if the laboratory is operated by a contractor), etc., for each activity identified in the UNIT DESIGNATION column.

(6) TFCU. Enter the quantity supported using the TFCU. Identify the quantity for each activity in the UNIT DESIGNATION column. Quantities included in the PMEL, DEPOT, and ON-SITE columns shall not be entered in the TFCU column. Also enter the actual or estimated total annual miles traveled and total annual days TDY in the designated spaces. Quantities supported using the jet engine test stand calibrator shall be reported in the ON-SITE column.

(7) ONSITE. Enter the quantity supported on-site by the reporting PMEL for each activity identified in the UNIT DESIGNATION column using equipment other than a TFCU. Do not include the quantity listed in the PMEL and TFCU columns.

(8) MOB. Enter the total quantity of TMDE coded as Mobility (i.e., contains M in the On Mobility PAMS field).

(9) WRM. Enter the total quantity of TMDE coded as WRM (i.e., contains a W in the On Mobility PAMS field).

Enter the total quantity supported for each of the PMEL, DEPOT, TFCU, ON-SITE, WRM, and MOBILITY columns at the bottom of each column.

6.1.4.4 Section III, PERSONNEL:

a. Block 18, Military.

(1) UDL AUTH. Enter the number of military personnel by CAFSC currently authorized.

(2) PMEL ASGD. Enter the number of military personnel by CAFSC currently assigned.

(3) ASGD FROM MAINT. Enter the number of military personnel by CAFSC assigned full time to the PMEL from authorizations of the Chief of Maintenance or comparable office.

(4) TOTAL. Enter the totals for each column under Block 18.

b. Block 19. CIVILIAN. Enter the series and grade of civilian personnel assigned to the PMEL; the number authorized; the number assigned; the number assigned full time from the authorizations of the Logistics Group Commander or comparable office; and the TOTALs for each column under Block 19.

c. Block 20, NUMBER OF ASSIGNED PERSONS PERFORMING DIRECT LABOR (*Technicians*). Enter the number of persons assigned to the PMEL whose primary duty is to calibrate and repair TMDE; i.e., those technicians assigned to labor code 100.

6.1.4.5 Section IV, FACILITIES:

a. SPACE AVAILABLE (*Sq Ft*).

(1) TOTAL PMEL (*Gross Space*). Enter the exterior dimensions of the building. If the PMEL is a joint occupant of a building, enter the exterior dimensions of the area occupied by the PMEL function and the percent of the total building occupied.

(2) CALIBRATION/REPAIR AREA. Enter the interior area (Sq Ft) of the room(s).

(3) OFFICE AREA. Enter the interior area (Sq Ft) of the room(s).

(4) RECEIVING/ISSUE/STORAGE AREA. Enter the interior area (Sq Ft) of rooms used for these functions and bench stock.

(5) TRAINING/TECH LIB/BREAK AREA. Enter the interior area (Sq Ft) of the room(s).

(6) CLEANING ROOM. Enter the interior area (Sq Ft) of the room(s).

(7) OTHER. Identify the purpose of the room(s) and enter interior area (Sq Ft).

6.1.4.6 Section V, SELF-SUFFICIENCY: This data is used for analysis by AFMETCAL Det 1 and the FAMS in determining the equipment support plans and other PMEL support problems. It also includes a list of items sent out for contract repair or calibration, plus a list of items under warranty and failed during this reporting period.

6.1.5 Self-Sufficiency List. Attach to the AFTO FORM 80, a listing of TMDE end items for which the PMEL has responsibility that must be sent to some other PMEL (usually a Type IIA PMEL) for calibration. Do not include items that are coded AFPSL, N49, N59, or N64 in the calibration responsibility field of a CMS or T.O. 33K-1-100-2. Include those items sent to another military service laboratory for calibration or repair. Include the ISA number in remarks column. If there is no ISA, enter "no charge" in remarks column. In addition, also record the items sent out on contract.

6.1.5.1 Headings for List. Lists shall be titled "Self-Sufficiency Report for *PMEL name"* and dated. Columnar headings for this list shall be:

* a. CAL_INFO_ID (not to be confused with Bar Code)

* b. RESP

* c. WUC

d. QUANTITY. This entry shall reflect the total quantity of this item (part number) not supportable by the PMEL.

e. WHERE SENT. List the designation code of the activity providing support.

f. REASON. Indicate what capability the PMEL lacks to provide calibration.

* h. REMARKS. Indicate whether the lack of capability is permanent or temporary. If temporary, indicate what action has been taken to attain capability and an estimated time when full capability will be achieved. For warranty items sent out, enter serial number of the item and contract number.

**i. WEAPON SYSTEM SUPPORTED. If a contract item, list the weapon system the item supports.

* The only entries required for warranty items.

** This entry only required for contract items.

6.1.6 Maintenance Data. This data is used by AFMETCAL DET 1/MLS to analyze reliability of TMDE and to adjust their calibration intervals. Attach to the report the MDC data for the reporting period from PAMS on MS-DOS formatted disks. Data may be submitted on 5 1/4" or 3 1/2" disks in regular or compressed format. The 3 1/2" disks are the preferred medium. Data may also be E-mailed as an attachment to **afmetcal.mdc@afmetcal.af.mil**. The data format shall be the same as the JDD AFS77SU data for the DO56 data system. If you need assistance in transferring the data from PAMS to disks, contact the PAMS Field Assistance Branch at Maxwell AFB, Gunter Annex AL, DSN 596-5771. If the PMEL does not use PAMS, submit the maintenance data as directed by AFMETCAL Det 1.

6.2 PMEL INVENTORY LISTING, RCS: HAF-ILM(A) 9450. The PMEL Inventory Listing, RCS: HAF-ILM(A) 9450, annual report was established to allow AFMETCAL Det 1 to generate a database that identified all items supported by any PMEL in the Air Force. It also permits generation of a list of PMELs that support a particular part number/model, as an example.

6.2.1 Report Requirements. This report requires that each PMEL provide a copy of the Local-Master-ID.Dat and OWC-Master.Dat files on a quarter inch cartridge tape produced on the PAMS system. If the PMEL does not use

PAMS, submit the inventory as directed by AFMETCAL Det 1. The total quantities of items contained in the inventory shall be equal to the total items supported as reported in your HAF-ILM(SA) 7808 report.

6.2.2 Report Date Due. The annual tape shall be current as of 31 December and shall arrive at AFMETCAL Det 1 not later than 31 January. Ensure that the mailed tape is in a package with the Optional Form 85 or an equivalent notice on it to prevent damage to the cartridge from magnetic fields.

SECTION 7

PMEL ASSESSMENT AND CERTIFICATION PROGRAM

7.1 GENERAL. As directed by AFI 21-113, AFMETCAL Det 1 is the Air Force focal point for the AFMETCAL Assessment and Certification Program. It maintains a system to assess and certify calibration laboratories for compliance with this T.O. and other Air Force directives. The Assessment and Certification Program objective is to assess the capability of each PMEL to perform measurements that are safe accurate, reliable, and traceable through the AFPSL to the National Institute of Standards and Technology (NIST) or other AFMETCAL Det 1 approved sources. An AFMETCAL Program Certificate of Compliance is awarded when a PMEL meets assessment criteria.

7.2 ASSESSMENT INTERVALS. The assessment team will assess each PMEL approximately every 24 months. Some short tour locations are assessed annually. Out-of-cycle assessments may be performed as required.

7.3 CERTIFICATION PROCESS. There are three stages in the PMEL certification process: Preassessment, On-site Assessment, and Certification review.

7.3.1 Preassessment. This includes a review of the PMEL documentation to assess compliance with this T.O. and other Air Force directives.

7.3.1.1 All laboratories shall submit the following:

a. Current Quality manual.

b. Master inventory data (when requested).

c. Previous 12 months of QP Summary Data as detailed in Section 9.

d. Copies of critical nonconformity worksheets and documents essential to understand the nonconformity.

e. Quarterly trend analysis documents for previous 12 months.

f. Environmental data summary as described in paragraph 7.3.2.2d.

g. A listing by K-Stamp number of the technicians qualified in each measurement area.

7.3.1.2 Quality system documentation shall be submitted in electronic format and through electronic means, to the greatest extent possible. When necessary, updated data may be requested at any time. On-site assessment shall normally occur after the PMEL quality system documentation is reviewed by AFMETCAL Det 1/MLC.

7.3.2 On-site Assessment. As a minimum the on-site assessment shall assess:

a. The PMEL implementation of their documented quality system and any corrective actions resulting from previous on-site assessments.

b. Measurement Capability Assessment (MCA): This shall include, but not be limited to processes for calibrating standards and TMDE; application of metrology principles and procedures; and condition and use of PMEL standards. The Assessment Team Chief, based on scope of calibrations performed and number of certifying technicians, shall select processes. The Assessment Team Chief shall provide PMEL management with a copy of the assessment plan during the in-briefing. Each TFCU and on-site operation shall also be subject to assessment and the results combined with the main PMEL to produce a final result.

c. Compliance with QP requirements.

d. Compliance with facility requirements.

e. Compliance with environmental requirements.

f. Proficiency Testing/ Measurement Assurance Program (PT/MAP).

7.3.2.1 PMEL Notification. AFMETCAL Det 1 shall provide the maximum practical advance notice to the affected command of the plan to visit their installation. The MAJCOM PMEL FAM shall notify the PMEL to be visited and all other interested parties of the following information: purpose of the visit, assessment team identity, and their arrival and departure dates.

7.3.2.2 Arrival Support Needed. The following information and support shall be available when the assessment team arrives:

a. The PMEL Quality Manual, and referenced quality documents

b. Full names, grades, titles, and mailing addresses of commanders and/or senior level managers

c. PMEL floor plan annotated with room, square footage, and location of ECS monitors

d. Environmental charts since the last on-site assessment, Environmental Restriction Log, and a summary of environmental data for each environmental monitor to include:

(1) Total hours recorded

(2) Total hours temperature above applied limits

(3) Total hours temperature below applied limits

(4) Total hours relative humidity above applied limits

(5) Total hours relative humidity below applied limits

(6) Total hours overlap (both temperature and humidity outside limits)

(7) Total hours of missing data (dry pens, clock stopped, chart overrun)

e. Copies of open facility and ECS work requests

f. Copies of command or local publications applicable to the operation of the PMEL

g. All records since the last on-site assessment applicable to the PMEL QP. This includes documentation of root cause analysis for all critical nonconformities identified and trend analysis performed.

h. Geodetic survey data

i. Documentation of facility ground measurements

j. RADIAC Program documentation (if applicable)

k. Records of qualifications, training, skills, and experience for all assigned personnel

l. Transportation, billeting, and other assistance as required

7.3.2.3 On-site Team Actions. The assessment team shall:

a. Upon arrival, brief PMEL personnel and the highest level commander (or designated representative) on the installation having jurisdiction over the PMEL to explain the purpose of the visit and assessment criteria to be used

b. Perform the assessment

c. Prior to departure, brief PMEL personnel and the highest level commander (or designated representative) on the installation having jurisdiction over the PMEL on the preliminary findings of the on-site assessment

7.3.2.4 Findings. Findings shall be documented as problems or observations as follows:

a. **Problems** are those deficiencies that affect the PMEL ability to perform accurate and traceable measurements, or demonstrate non-compliance with published directives. To achieve certification, all identified problems shall be corrected or identified in a corrective action plan (CAP). A CAP shall be requested when identified problems require a formal response from the PMEL. When requested, the CAP shall be provided to AFMETCAL Det 1 within 60 calendar days of the final report date. The CAP shall contain as a minimum: the documented problem(s), detailed corrective actions, and a time schedule for resolution of the problem(s).

b. **Observations** include minor deficiencies that do not directly affect accuracy or traceability, recommendations that may improve products, processes, or services, and positive comments. Observations do not affect certification and do not require a response from the PMEL. However, when a large number of

observations are noted and the cumulative effect may be detrimental to the quality of PMEL products, processes, or services, the assessment team may document the overall situation as a problem

7.3.3 Certification Review. Certification review begins upon completion of the on-site assessment. During this period all PMELs shall be in a status of "certification pending" until the Commander of AFMETCAL Det 1 renders a certification decision that is published in the final evaluation report. During certification review, the Certification Office shall validate assessment findings and review short term PMEL corrective actions. On completion of the certification review, the Certification Office shall forward a recommendation to the Commander of AFMETCAL Det 1 to certify, withhold, or close the PMEL.

7.3.3.1 Certification Criteria. The following criteria shall be assessed to determine if a PMEL meets the minimum requirements. Findings shall be compiled from objective evidence in these areas:

a. Quality System Documentation. The PMEL Quality Manual shall meet the requirements of this T.O.

b. Measurement Capability Assessment. The PMEL shall demonstrate the capability to perform traceable measurements.

c. Quality Program. The QP shall meet all requirements of this T.O.

d. Facility. The facilities shall comply with operational requirements of this T.O. and applicable Air Force directives.

e. ECS. The ECS shall comply with operational requirements of this T.O. and applicable Air Force directives.

f. PT/MAP. Documentation and measurement results shall comply with the requirements of this T.O.

7.3.3.2 Certification Decision. AFMETCAL Det 1 shall certify the PMEL when assessment results and any corrective actions demonstrate the PMEL is compliant with this T.O. When assessment results indicate that the PMEL does not meet certification criteria, AFMETCAL Det 1 may convene the PMEL Certification Panel and/or take one or more of the following actions:

a. Certify the PMEL.

b. Determine specifically what is needed to bring the PMEL to full capability.

c. Initiate corrective action within the capability of the AFMETCAL Det 1.

d. Notify the Air Staff and the major command of the reasons for considering the PMEL incapable, any limitations imposed, the actions required to achieve certification, and recommendations for obtaining calibration support pending completion of corrective actions.

e. Conduct technical assistance visits to aid in resolving problems when requested by the major command.

f. Withhold the PMEL certification until the problems identified during the assessment are corrected.

g. Recommend the assessment team perform a follow-up on-site assessment. AFMETCAL Det 1 shall coordinate this action with the affected MAJCOM.

h. Recommend closure.

7.4 PROFICIENCY TESTING/ MEASUREMENT ASSURANCE PROGRAM (PT/MAP). PMELs shall be required to complete proficiency testing as directed by AFMETCAL Det 1. Proficiency Testing is the process used to assess laboratory performance by means of comparing and evaluating calibrations or tests on a measurement artifact. Measurement artifacts will be sent to the PMELs to be measured and the results will be compared to measurements made at the AFPSL on the same artifact.

7.4.1 Measurement artifacts for selected measurement areas shall be distributed to PMELs by the AFPSL based on a schedule determined by AFMETCAL Det 1. The number of proficiency tests required of each PMEL annually will vary depending on the availability of measurement artifacts, but shall not exceed six (6) artifacts per PMEL annually. The AFMETCAL Assessment and Certification Program shall consider the results of proficiency tests as objective evidence, along with Preassessment and on-site assessment findings, of the PMEL's ability to perform competent calibrations.

7.4.2 Proficiency testing shall be scheduled by the AFPSL on behalf of AFMETCAL Det 1. PMELs shall be notified in advance as to the approximate arrival date of the measurement artifact. Instructions for performing the test, reporting results, notifying AFMETCAL Det 1 and the AFPSL, and shipping will be included with the measurement artifact.

7.4.3 The PMEL shall be required to perform measurements on an artifact using the same calibration methods used to calibrate customer equipment or methods directed by AFMETCAL Det 1. The PMEL shall report results as indicated in the PT/MAP instructions and data sheets provided by AFMETCAL Det 1. The PMEL is expected to complete proficiency testing of a measurement artifact within the time allotted in the PT/MAP instructions. The measurement artifact shall not leave the PMEL unless otherwise directed by the PT/MAP instructions.

7.4.4 Unless otherwise stated in the PT/MAP instructions, the performance of the proficiency test is judged by calculating the error, normalized with respect to the uncertainty, of the measurement as follows:

$$E_{\text{normal}} = \left| \frac{Value_{\text{PMEL}} - Value_{\text{ref}}}{\sqrt{Uncertainty_{\text{PMEL}}^2 + Uncertainty_{\text{ref}}^2}} \right|$$

Where
E_{normal} = normalized error of the PMEL
$Value_{\text{PMEL}}$ = the value as measured by the PMEL
$Value_{\text{ref}}$ = the value as measured by the AFPSL (reference laboratory)
$Uncertainty_{\text{ref}}$ = the overall uncertainty of the AFPSL (reference laboratory)
$Uncertainty_{\text{PMEL}}$ = the overall uncertainty of the PMEL (i.e., Measurement uncertainty that would be provided to a customer)
Note: All Values and Uncertainties shall be expressed in the same units. To pass the proficiency test the PMEL shall have a value for E_{normal} less than 1 (i.e., $E_{\text{normal}} < 1$).

7.4.5 AFMETCAL Det 1 shall notify the PMEL of their proficiency testing results. If a PMEL has been certified prior to the completion of the proficiency test, the status of the certification may change as a result of a failed proficiency test. The PMEL certification status may be changed to reflect a partial certification or completely suspended pending the PMEL's ability to successfully complete the proficiency test at a later date.

7.5 CERTIFICATION STATUS . PMEL certification status shall be specified in the final assessment report as one of the following:

7.5.1 Certified. A PMEL whose quality system documentation, MCA, QP, PT/MAP, facilities, and ECS demonstrate the PMEL has the capability to perform accurate and traceable measurements shall be issued a Certificate of Compliance at the conclusion of the on-site assessment. The certificate, combined with the final assessment report, is proof of compliance with this T.O. and other applicable Air Force directives. The Certificate of Compliance shall remain in effect unless revoked by AFMETCAL Det 1. All previous certificates are void when final certification status is certified, withheld, or recommended for closure. Certification shall be reassessed if the contractor changes or the PMEL relocates to a different facility (Facility may include RASCAL units and on-site operations used as an extension of the main PMEL). AFMETCAL certification is proof of AFMETCAL Program compliance and should not be confused with third-party accreditation under commercial guidelines.

7.5.2 Certification Pending. Draft evaluation reports are considered unofficial "pending review". The final evaluation report may reflect a final status of pending when further data or action is required. A previously issued Certificate of Compliance remains in effect during this period. A final status of pending will change to withhold if the required data of action is not accomplished by deadlines specified in the final report.

7.5.3 Certification withheld. The PMEL failed to demonstrate the capability to consistently perform safe, accurate, reliable, and traceable measurements. In most cases, calibrations may continue under increased surveillance of the problems or measurement areas that resulted in withhold. Refer to the final evaluation report.

7.5.4 Not certified, recommended for closure. Problems in quality system documentation, MCA, QP, facility, ECS, or PT/MAP prevent the PMEL from making accurate and/or traceable measurements and resolution is not expected.

7.6 ASSESSMENT REPORTS. The assessment team shall prepare a report for each assessment.

7.6.1 Report Content. The report shall concisely and clearly describe the effectiveness of the quality system documentation, MCA, QP, facility, ECS, and PT/MAP.

7.6.2 Report Distribution. AFMETCAL Det 1 shall distribute one copy of the report for all PMEL assessments to the Wing Commander (or equivalent) and the affected major command. For laboratories not certified, one copy of the final report shall be forwarded to HQ USAF/ILMM, the affected MAJCOM, and the Wing Commander (or equivalent). One copy of all reports shall be maintained at AFMETCAL Det 1.

7.7 APPEAL PROCESS. The PMEL may appeal any finding or comment in the assessment report or the decision of AFMETCAL Det 1 by forwarding relevant information to AFMETCAL Det 1. AFMETCAL Det 1/CC may convene the PMEL Certification Panel for advice. The subsequent decision of the AFMETCAL Det 1/CC is final.

SECTION 8

PMEL FACILITY OPERATIONAL REQUIREMENTS

NOTE

This section does not contain PMEL design criteria. They are contained in AFMAN 32-1094 Criteria for Air Force Precision Measurement Equipment Laboratory Design and Construction.

8.1 GENERAL REQUIREMENTS. This section contains PMEL facility operating parameters and/or notes concerning environment, power, lighting, air filtration, air locks, controlled areas, cleaning area, flooring, ceilings, and other subjects. One purpose of this section is to ensure that PMELs placed in buildings not built according to AFMAN 32-1094 meet minimum requirements. This section also contains some of the general information needed to determine space requirements within some of the laboratory areas. The data in this section provides guidance for the day-to-day operation of the PMEL as it relates to the facility. PMEL management shall make every effort to establish and maintain the PMEL facility in a condition facilitating proper performance of calibrations/verifications.

8.1.1 Design Criteria. AFMAN 32-1094 contains the design criteria for Type II() and Type III PMELs on Air Force installations and shall be complied with when modifying or repairing an existing PMEL, or designing a new PMEL facility. PMEL designs and layouts shall be evaluated on an individual basis and shall depend upon mission requirements. These criteria shall not be used as sole justification to improve facilities if conditions of existing facilities do not adversely affect the environmental requirements or mission performance of the PMEL. Assistance for determining facility requirements may be obtained from AFMETCAL Det 1/ML. Each PMEL shall maintain a file reflecting any deviation from AFMAN 32-1094, which was approved by AFMETCAL Det 1/ML and/or HQ AFCESA.

8.1.2 Coordination of Plans for Facility Projects.

8.1.2.1 When any PMEL or major command first decides to build a new PMEL or modify an existing PMEL, AFMETCAL Det 1/ML shall be provided all justification available so AFMETCAL Det 1/ML can update long range planning and ensure interservice coordination of applicable projects. AFMETCAL Det 1/ML shall forward appropriate comments and recommendations to the command headquarters.

8.1.2.2 When a project is approved for construction of a new facility or modification/improvement of an existing facility, the PMEL superintendent shall ensure that the command's PMEL functional area manager is placed on distribution and provided with a copy of the design criteria, specifications, and drawings.

8.1.3 PMEL Power Requirements. PMEL power requirements are listed in AFMAN 32-1094. Equipment, which is critically sensitive to line voltage variation, shall require additional voltage regulation through use of bench type regulators and/or filters.

8.1.4 Grounding Requirements. The ground in the PMEL shall be checked to ensure it has retained its validity per AFI 32-1065 (once every two years). Measurement techniques for grounds are shown in T.O. 31-10-24. PMEL management shall maintain a copy of inspection forms provide by Civil Engineering IAW AFMAN 23-1065.

8.1.5 Geophysical Surveys. Most PMELs require certain geophysical surveys to be performed. AFI 14-205 gives information about obtaining these surveys. These surveys are only required when any of the following sub-paragraph measurement capabilities are required. Surveys are as follows:

a. World Geodetic System of 1984: Geodetic positions, Latitudes and Longitude in degrees, minutes, and seconds. Required in order to perform accurate time measurements. Loran C requires a minimum 10 arc seconds accuracy for latitude and longitude.

b. International Gravity Standardization Net of 1971 (IGSN 71): Gravity information in milligals. The required accuracy for use with dead weight piston pressure standards is 5 mGals. As long as the PMEL does not move, there is no need for an update. If your PMEL has moved to a new location, then your force and pressure standards shall be recalibrated using the new gravity value before they can be used to obtain maximum accuracy.

c. Astronomic Data. Astronomic azimuth in degrees, minutes, and seconds. Needed if the PMEL is supporting north-seeking gyro-compass units. Accuracy needed is 10 arc seconds or less.

8.2 PMEL ENVIRONMENT. T.O. 33K-1-101-CD-1 identifies the measurement restrictions of measurement standards. To ensure measurement accuracy, it is necessary to maintain continuous control of the environment in which the measurement standards are maintained. Temperature, humidity, dust, vibration, and electromagnetic interference can each have a detrimental affect on the ability of a standard to ensure measurement accuracy of TMDE. Each of the environmental factors impact calibration and repair operations to a different degree. It is a fact that most standards change value with a change in temperature. The temperature limits placed on the PMEL ensure that the measurement confidence level meets the needs of some of the more precise equipment. Humidity control is becoming a very significant environmental need in the PMELs, especially at the lower humidity levels because of the potential for electrostatic discharge (ESD) damage to integrated microcircuitry, as well as its interference with sensitive measurements. Therefore, a PMEL whose environment goes outside the limits for temperature and humidity cannot ensure calibration accuracy and/or presents an operating hazard to some element of the measurement setup. The calibration procedures may provide other restrictions.

8.2.1 PMEL Environmental Control System (ECS) Effectiveness. When the PMEL ECS cannot maintain environmental specifications 90% of the time or more, aggressive action on the part of PMEL/upper-level management is required. Excessive out-of-tolerance periods can contribute to production slow-downs or stoppages.

8.2.2 Documenting ECS Outages. Laboratory management shall ensure nothing listed as environmentally sensitive is to be calibrated during environmental outages, unless special provisions are made, documented, and the documentation kept on file.

8.2.3 PMEL Operational Environment. The following operational environmental requirements apply only to a PMEL area where calibration/ repair is performed. Particular care shall be taken when calibration/ repair is performed at a site other than the permanent PMEL premises. Keep in mind these are operational requirements, not design requirements.

8.2.3.1 Present measurement needs dictate the operational temperature in the PMEL facility shall be controlled as follows, unless the calibration procedure specifies other restrictions:

8.2.3.1.1 Calibration and Repair area. A temperature of 73°F ±6°F (22.8°C ±3.3°C) in the calibration and repair areas of Type II or III PMELs, except for the 68°F dimensional calibration area.

8.2.3.1.2 Dimensional 68°F Calibration and Repair area. A temperature of 68°F ±1.0°F (20°C ±0.56°C) shall be maintained in the 68°F dimensional area of PMELs where 68°F dimensional areas are authorized (see paragraph 10.3). The 68°F dimensional calibration area criteria is based on the need for a closely controlled environmental area for calibration and use of higher accuracy dimensional TMDE. By international agreement the true size and shape of an object is that which exists at a uniform temperature of 68°F (20°C).

8.2.3.1.3 Temperature in the low and high intensity Radiac area may vary from 73°F to ±15°F. The relative humidity in the area during calibration shall not exceed 70%. Another condition is that radiac meters shall not be stored for any extended periods in an environment with RH above 50%.

8.2.3.2 An optimum operational humidity level is 35% RH. The relative humidity shall not be allowed to go lower than 20% RH or exceed 50% RH in any Type II or Type III PMEL.

8.2.3.3 Temperature and humidity shall be monitored and recorded continuously. Span calibrations are encouraged for recorders used to monitor the environment in calibration areas. The span shall cover the operational requirement of the PMEL. The following rules apply to temperature and humidity recorders:

a. Recording devices monitoring 68 °F calibration and repair areas shall be calibrated a minimum of +/- 0.5 °F, 5% RH.

b. Recording devices monitoring 73 °F calibration and repair areas shall be calibrated a minimum of +/- 2.0 °F, 5% RH.

c. If a computerized system is used to record environmental data, the time between data samples shall not exceed 15 minutes.

8.2.3.3.1 Typically a recording device is required for each 2000 ft^2 of calibration and repair area or per room if smaller than 2000 ft^2.

8.2.3.3.2 Recording device(s) shall be located in close proximity to areas where the most stringent calibrations are performed. Locate the recording device so that exterior wall temperature, high heat producing equipment, and supply air do not adversely affect the recorder indication.

8.2.3.3.3 Psychrometer readings (accomplished IAW established calibration procedures for hygrothermographs) shall be accomplished weekly (usually at the time of chart change) to check the accuracy of the recorder. The start and stop date, standard thermometer, psychrometer, (wet bulb and calculated humidity) shall be annotated on each chart.

NOTE

If the temperature and humidity chart recorder meets required accuracy and is calibrated through the entire span of the PMEL applicable temperature and humidity range, psychrometer readings are not required.

8.2.3.3.4 Some recorders are slow responding. Differences between the psychrometer and recorder do not necessarily mean adjustments are required. Ensure the psychrometer is used properly and take a number of readings. Adjust the recorder only if repeated comparisons indicate the need.

8.2.3.3.5 For those recorders not requiring weekly chart changes (i.e., continuous roll type graph or other electronic recorder) a psychrometer check is only required after any of the following instances:

a. Quarterly

b. Graph paper is changed (if the recorder uses graph paper)

c. If any malfunction is suspected

If logging psychrometer readings on recorders of this type is impractical, a log may be substituted for recording the readings. Should the psychrometer readings indicate a recorder is outside its rated accuracy for either temperature or relative humidity, the recorder shall then be adjusted within tolerances. It is also recommended that the environmental charts for each area monitored be filed in separate folders to facilitate periodic review. Span calibrations are encouraged for recorders used to monitor the environment in calibration areas. The span shall cover the operational requirement of the PMEL.

8.2.3.4 Because the measurement accuracy of many standards is affected by environmental changes, the environment shall be maintained within the foregoing environmental criteria (limits). This includes periods when the PMEL is not in operation but items are being "soaked" prior to calibration. When this is not possible, the following applies:

a. When the environmental system regains control, the PMEL environment shall be allowed to reach stability. Humidity out-of-tolerance conditions do not require a soak time, but metallic surfaces may require cleaning during and after periods of high humidity. The stable condition starts when the temperature excursions remain within the 73°F ±6°F range (68°F ±1° for the dimensional area) and repeatable measurements can be made. This time is sufficient for all measurements except as follows:

   (1) Optical Flats (7 inches in diameter and larger): Do not calibrate or use without a "soak" time of 3 hours for every hour the environment is out-of-tolerance, up to a maximum of 24 hours "soak" time.

   (2) Linear dimensions (1 inch and shorter): For accuracies better than ±0.0001 inch, provide a "soak" time of one and one-half hours for each hour the environment is out of specification to a maximum of 12 hours prior to calibration or use of instruments.

   (3) Linear dimensions (longer than 1 inch): For accuracies of ±0.0001 inch/inch through ±0.001 inch/inch, provide a "soak" time of one and one-half hour for each hour the environment is out-of-tolerance up to a maximum of 12 hours prior to calibration or use. For accuracies better than ±0.0001 inch/inch, provide a "soak time" of three hours for each hour the environment is out-of-tolerance up to a maximum of 24 hours.

   (4) In each temperature case identified above, the total "soak" time shall be equal to that specified, plus any waiting time that may be required to achieve repeatability of readings.

b. PMEL operations affected by humidity shall cease as long as the humidity is out of specifications. No trouble shooting/repair shall be performed on ESD vulnerable (CMOS-MOSFETs-MOS) solid-state equipment when the humidity falls below 20% unless the following occurs: The use of ion generators may provide an acceptable environment for a localized area such as a workbench with a low ESD potential. This would permit repair and calibration on the bench even though the rest of the calibration and repair area is below the 20% humidity level. The PMEL shall periodically monitor the operation of ion generators to ensure the ion generator is providing safe ESD environmental conditions. ESD control procedures are described in MIL-HDBK-263, MIL-STD-1686, and T.O. 00-25-234.

8.3 TMDE ENVIRONMENTAL RESTRICTIONS. PMELs shall conform to the maintenance T.O. or manufacturer's data regarding any environmental limitations or temperature coefficients of any item used in a measurement setup. The calibration T.O. may state specific environmental conditions, which shall be met, for the calibration.

8.4 DUST LEVELS. Dust is an enemy that makes it difficult to make accurate measurements in some measurement areas. The easiest way to keep dust out of the PMELs calibration and repair area is to have a positive airflow from the environmental system and/or locate the PMEL within an area of a building, which is relatively dust-free. Ensuring the filters in the ECS are clean is another major factor in keeping dust levels down. Vacuum cleaning, use of lint free dust cloths, and reduction of horizontal plane surfaces minimizes the effects of dust. Devices producing dust or residue particles from grinding or abrasion shall not be installed in, or used in, the calibration and repair area of the PMEL.

8.5 NOISE. It is recommended that the noise level in the PMEL be no greater than 70 dB. AFOSHSTD 48-19, Chapter 2, identifies hazardous noise exposure limits.

8.6 VIBRATION. The PMEL areas where calibration is performed shall be maintained as vibration free as possible. The cause of vibration, which affects the repeatability of TMDE, shall be identified and reduced to acceptable levels. The PMEL shall notify AFMETCAL Det 1/ML of any vibration problems that cannot be solved. An acceptable vibration level for a PMEL is anything less than 0.25 mm (10 μ in) from 0.1 to 30 Hz (displacement peak). The maximum acceleration peak is 0.001 G for frequencies from 30 Hz to 200 Hz.

8.7 ELECTROMAGNETIC INTERFERENCE (EMI)/RADIO FREQUENCY INTERFERENCE (RFI). EMI that causes degradation of equipment performance and disruption of calibration shall be suppressed or eliminated to the maximum extent possible.

8.7.1 New PMEL Facilities. The effects of EMI to PMEL equipment shall be minimized through the selection of locations for new PMEL facilities where the ambient radio frequency (RF) field strengths from 10 kHz to 18 gHz shall not exceed 1 V/m external to the proposed facilities. An electromagnetic compatibility (EMC) survey shall be performed for each proposed PMEL facility site. The results of the EMC survey shall be used to determine site suitability. The surveys shall be performed by the 738 EIS/EEEX in accordance with 38 EIW Instruction 33-101, Measurements and Specialized Engineering Services (MSES). Upon completion of the EMC survey, a formal engineering report shall be supplied to both the PMEL customer and AFMETCAL Det 1/ML.

8.7.2 Existing PMEL Facilities. EMI that causes degradation of equipment performance or disruption of calibration at existing sites shall be eliminated or suppressed to the maximum extent possible. The PMEL shall report apparent EMI problems to the 738 EIS/EEEX in accordance with AFI 10-707, Air Force Spectrum Interference Resolution Program. The 738 EIS shall provide on-site assistance in determining the source(s) of the EMI and propose solutions for the elimination or suppression of the EMI. Upon completion of the EMI survey a formal engineering report shall be provided to both the PMEL customer and AFMETCAL Det 1/ML.

8.7.3 Obtaining Related Assistance. An EMI or EMC survey shall be obtained through a request to the 738 EIS/EEEX at the following location:

738 EIS/EEEX
801 Vandenburg Ave, Ste 201
Keesler AFB MS 39534-2634

Voice: DSN 597-3920 Comm 601-377-3920
FAX: DSN 597-3956 Comm 601-377-3956

8.8 LIGHTING.

8.8.1 General Lighting. The general lighting for all occupied areas shall be balanced to minimize shadows and produce uniform illumination.

8.8.2 Minimum lighting. Minimum lighting levels are specified to reduce the need for additional lighting fixtures in the calibration and repair area because they become dust collectors and can interfere with setting up a measurement capability. Proper illumination is required to perform precision measurements.

8.8.3 Uniform Illumination. Uniform illumination is defined as a distribution of light at the measured height where the maximum and minimum general illumination in the immediate work area (e.g., bench top, testset up) is not more than one-sixth above or below the average illumination in the area.

8.8.4 Measurement of Lighting. The average room illumination for general lighting shall be measured after 100 hours of use in the calibration and repair area at the level of the horizontal working surface of the PMEL bench and in the administrative areas at desk top level. The surface shall be free of items and adjacent personnel during the measurement so as to minimize shadows on the light meter sensor. The illumination level can drop drastically during the initial burn-in time.

		Absolute Minimum
a.	Calibration/Repair/Dimensional	50 Foot Candle(FC)
b.	Cleaning	50 FC
c.	Office and Administrative	50 FC
d.	Technical Library	50 FC
e.	Training Room	50 FC
f.	Receiving, Issue	50 FC
g.	Bench Stock	20 FC
h.	AWM/AWP Holding	10 FC
i.	Stairways, Corridors, Airlock	20 FC
j.	Elevators, Shipping Dock	20 FC or *
k.	Restroom, Utility, Storage	10 FC or *

* Not less than 1/5 of the brightest adjacent traffic area.

8.8.5 Supplementary Lighting. Additional general lighting shall be used for tasks that are difficult to perform within the ambient light level.

8.8.6 Lighting Fixtures. Fluorescent lamps shall be used wherever possible to conserve energy. Relamping of fluorescent luminaries shall be done using new fluorescent lamps of a white or daylight variety. They shall have an initial rated lumen output after 100 hours use of not less than 98% of the Illuminating Engineering Society rating for a cool white T-12 medium bipin lamp in the luminaire size lamp. Areas having special spectral emission requirements shall be lamped accordingly.

8.8.7 Energy Conservation. Lighting may be turned off during non-working hours providing:

8.8.7.1 Due consideration is given to the effects on air conditioning reheat systems to ensure that energy is used efficiently by turning off the lights.

8.8.7.2 Environmental limits can be maintained with the lighting turned off.

8.9 DOORS & WINDOWS. All windows and unused doors or other openings shall be sealed to prevent non-conditioned air infiltration and dust contamination from outside. Doors opening into the PMEL shall be designed and arranged so as to maintain effective dust and temperature controls. The doors for personnel passage shall be held to a minimum consistent with fire and safety regulations. A building with no windows in the calibration and repair area of the building is preferred because of the potential effect of the direct sunlight on measurement. There may be windows in the calibration and repair area as long as they are not in outside walls of the building because direct sunlight in the PMELs could cause higher temperature in small areas.

8.10 AIR LOCKS. Air locks shall be constructed at the entrance to the calibration and repair area of the PMEL. An exception can be made if the PMEL is contained inside another environmentally controlled building and the PMEL calibration and repair area has positive air pressure in relation to the outside environmentally controlled area. Shoe cleaners with a self-contained vacuum system (or external vacuum system) shall be located where they will be most effective in reducing contamination that might be carried into the calibration and repair area of the PMEL. Air locks and shoe cleaners are not required for Type IV PMELs. Carpeting shall not be installed in air locks due to possibility of the carpeting interfering with the operation of air lock doors.

8.11 CONTROLLED AREAS.

8.11.1 Dedicated Laser Room. Any laser system that would interfere with or cause a safety problem for adjoining operations shall be placed in a dedicated room or area. The base bioenvironmental engineer can assist in determining the need for a separate room. Also refer to AFOSHSTD 48-139. Size and configuration of the area depends upon the laser system. The HP 5528A is a typical laser not requiring a dedicated room.

8.11.2 Other Measurement Area. The PMEL shall define and control access to areas where unnecessary presence (electrostatic) or excessive body heat (68 degree room) may affect quality.

8.12 FLOORING. Selection of a floor covering for the calibration area is based on the characteristics of durability, resilience, ease of maintenance, and electrical insulation properties. Light colors are recommended due to their reflection. Carpeting is not permitted due to dust collection and ESD concerns. A high grade of commercial vinyl plastic floor covering material of continuous length is preferred. Installed asphalt, rubber, vinyl asbestos, or vinyl tile that is in serviceable condition may continue to be used. Deteriorating vinyl asbestos tile may become a hazard. Contact your local bioenvironmentalist if the vinyl asbestos tile begins to deteriorate. Tile seams shall be flush and tight. Coved corners and edges are desirable to simplify cleaning. The continuous length floor covering provides a higher resistance to ground than the individual tiles and it simplifies the cleanup of hazardous materials such as mercury spills. Do not wax the floors.

8.13 FURNITURE AND FIXTURES. All furniture and fixtures shall be of a design that prevent accumulation of dust and facilitate cleaning. Working surface shall be covered with laminated plastic that is resistant to heat, chemicals, chipping, or other deterioration. Cabinets or lockers will be flush mounted, if possible.

8.14 FMS TYPE IV AND TYPE II () PMEL FACILITY REQUIREMENTS. The following Type IV PMEL and supporting Type II () PMEL facility requirements are in support of FMS customers only.

8.14.1 F-15 Type IV PMEL Requirements.

8.14.1.1 Electrical Power.

a. 200 wye/115 +3-7 VAC, 3 Phase, 4 wire, 400 ±20 Hz, 10 KVA.

b. 120 VAC ±10% 1 Phase, 3 wire, 60 ±6 or 50 ±3 Hz, 20 KVA.

c. 240 VAC ±10% 1 Phase, 3 wire, 60 ±6 or 50 ±3 Hz, 10 KVA.

d. Grounding shall be in accordance with AFMAN 32-1094, measurement techniques per T.O. 31-10-24.

8.14.1.2 Lighting. (See paragraph 8.8.)

8.14.1.3 Temperature and Humidity Controls. A temperature of 73°F ±9°F and humidity control of 15 to 70% RH shall be maintained in the calibration and repair areas. The measurement restrictions of Table 2 in T.O. 1F-15A-37 apply. Temperature and humidity shall be continuously monitored and recorded.

8.14.1.4 Floor Space. Minimum space to support one ESS is 1,634 ft^2. Two ESSs require 2234 $feet^2$. This may vary if the unit has been mobilized. If the Type IV is consolidated into the Type II, this is the additional space that could be required in the Type II.

8.14.1.5 Additional Requirements.

8.14.1.5.1 Capping of unmated connectors is not required.

8.14.1.5.2 A portable or central vacuum cleaning system is required to clean TMDE and for general housecleaning. Cleaning TMDE within the calibration/repair area is acceptable, but is restricted to use of vacuum, small brushes, and small hand-held nontoxic spray-and-wipe cleaning. Where toxic fumes, excessive dust, or other safety hazards exist, cleaning shall be accomplished in an approved area outside the calibration and repair area. This includes devices containing mercury, such as manometers and barometers.

NOTE

Eating or drinking in the Type IV is permitted only in a designated area set aside for that purpose. A designated eating area is not authorized in the Type IV if an existing break area is convenient. No calibration or repair is permitted in that area.

8.14.2 F-15 Supporting Type II () PMEL Requirements.

8.14.2.1 A 16' X 15' floor area is required within the calibration/ repair area to accommodate a 6' X 3' granite surface plate and a line-of-site area for optical calibration of a HUD Mount Alignment Adapter. Floor loading beneath the surface plate shall be capable of supporting the surface plate (3,000 pounds), a granite angle block (1,500 pounds) plus other ancillary equipment. Total loading is for 5,000 pounds. The surface plate is mounted on either a tripod or a quadruped stand with four inch rectangular feet. Casters are normally provided on the stand.

8.14.2.2 An increase in workload of approximately 300 items of F-15 related support equipment could be expected in the Type II.

8.14.3 F-16 Type IV PMEL Requirements.

8.14.3.1 Electrical Power.

a. 200 wye/115 +3-7 VAC, 3 Phase, 4 wire, 400 ±20 Hz, 10 KVA

b. 120 VAC ±10% 1 Phase, 3 wire, 60 ±6 or 50 ±3 Hz, 20 KVA.

c. 240 VAC ±10%, 1 Phase, 3 wire, 60 ±6 or 50 ±3 Hz, 10 KVA.

d. Grounding shall be in accordance with AFMAN 32-1094, measurement techniques per T.O. 31-10-24.

8.14.3.2 Temperature and Humidity Controls. Temperature shall be maintained between 73 ±9°F and humidity shall be maintained between 15 and 70% RH. These temperature and humidity limits differ from those of the Type II PMEL in order to permit use of the least restrictive facility requirements. These limits allow full use of the equipment. Temperature and humidity shall be continuously monitored and recorded.

8.14.3.3 Floor Space. Minimum area for one set is 1040 ft^2 , two sets is 1,600 ft^2. If the Type IV is consolidated into the Type II, this is the additional space that could be required in the Type II.

8.14.3.4 Lighting. (See paragraph 8.8.)

8.14.3.5 Additional Requirements.

8.14.3.5.1 Capping of unmated connectors is not required.

8.14.3.5.2 A portable or central vacuum cleaning system is required to clean TMDE and for general housecleaning. Cleaning TMDE within the calibration/repair area is acceptable, but is restricted to use of vacuum, small brushes, and small hand-held nontoxic spray-and-wipe cleaning. Where toxic fumes, excessive dust, or other safety hazards exist, cleaning shall be accomplished in an approved area outside the calibration repair area. This includes devices containing mercury, such as manometers and barometers.

NOTE

Eating or drinking in the Type IV is permitted only in a designated area set aside for that purpose. A designated eating area is not authorized in the Type IV if an existing break area is convenient. No calibration or repair is permitted in that area.

8.14.4 F-16 Supporting Type II() PMEL Requirements.

8.14.4.1 Type II() PMELs supporting the F-16 may require additional floor space to accommodate a 3' X 6' surface plate and stand. A surface plate of this size shall require a working area approximately 15 X 16 feet. Floor loading beneath the surface plate shall be capable of supporting approximately 5000 pounds (the 3500 pound surface plate plus ancillary blocks).

8.14.4.2 Additional workspace may be required in a Type II PMEL supporting an F-16 ESS. An increase in workload of approximately 200 items of F-16 related support equipment can be expected in the Type II.

8.15 ENVIRONMENTAL LIMITS FOR USNS OBSERVATION ISLAND AND RASCAL.

8.15.1 USNS Observation Island environmental operating limits are as follows:

Temperature	=	73 ±6°F.
Humidity	=	15% RH to 70% RH.

8.15.2 RASCAL environmental operating limits are as follows:

Temperature	=	73 ±6°F.
Humidity	=	20% to 50% RH.

SECTION 9

QUALITY PROGRAM (QP)

9.1 QUALITY PROGRAM. The QP is a significant part of the overall quality system. The purpose of the QP in the AFMETCAL Program is to ensure weapon system safety, accuracy, reliability, and traceability. The QP accomplishes two primary functions; collect PMEL quality data and use that data. First, PMEL personnel referred to as PMEL Quality Assurance (PQA) evaluators collect data to provide management personnel an overall picture of quality system effectiveness. PMEL management shall designate highly qualified PQA evaluators in writing. PQA evaluators shall not review their own products or processes. Second, PMEL supervisors and managers use the collected QP data to proactively monitor and control the quality of PMEL products and processes. By using QP data to identify the most significant problems and negative trends, managers can implement corrective actions to eliminate or minimize these problems and trends. All QP activity shall be thoroughly documented.

9.2 TYPES OF REVIEW. There are three types of reviews. Two of these reviews focus on the quality of the product. They are Quality Reviews (QR) and Standard Reviews (SR). A critical nonconformity discovered during QRs and SRs may be a negative indicator of laboratory performance. It means that a piece of TMDE or a laboratory standard, has a product quality defect. The third type of review, the Process Review (PR), is a management tool for internal investigation and process improvement and shall not be used or reported as an indicator of laboratory performance. Finding PR nonconformities is a first step in preventing QR and SR nonconformities. Because USAF PMEL workload is so diverse, it is impractical to sample enough TMDE to ensure end-of-line quality. Reviews under the QP are intended to sample PMEL production, categorize the defects, and determine the biggest problem areas in the PMEL. Management is then able to focus improvement efforts on the most significant laboratory problems. The QP is not intended to fix individual equipment deficiencies. Technicians, supervisors, and PQA personnel find and fix individual defects in the course of their daily activities.

9.3 QUALITY REVIEW. A QR is a complete review of TMDE produced or certified. The QR alone does not sample enough TMDE to assess the overall quality of PMEL production. However, it does reveal product quality defects that may be the result of a faulty laboratory process. These defects point management toward areas that require further investigation using root cause analysis.

9.3.1 TMDE shall be randomly selected and completed at a rate averaging no lower than 3 percent of production subject to QR per any 12-month period. The following MDC Action Taken codes are subject to QR: A, B, F, G, J, K, V, X (except QRs), and NRTS codes 0-9. ATE and TMDE calibrated on site are subject to the same selection criteria and method of review. A QR may be bypassed only when extraordinary reasons prevent completion. PMEL Management shall document, in the PMEL QM, the local policy for bypassing QRs and document a method of pre-selecting TMDE for QR that are inherently difficult to sample after certification (e.g. off-base, priority, jet engine test stand, etc).

9.3.2 The QR includes the following:

a. Safety compliance.

b. Full parameter verification.

c. Physical condition.

d. Documentation (e.g. forms, labels, task qualification, etc.)

e. Traceability (e.g. standards, reports, technical data, environment, facility, etc.)

9.3.3 PMEL management shall document the procedures to be followed when full parameter verification is not performed. Although full parameter verification may not be possible on all items selected for QR, the review shall be performed even when the PMEL process did not include calibration. For example:

a. Items with NRTS action taken codes shall be verified to ensure the NRTS action is appropriate.

b. Items processed with 'G' action taken codes require verification that the item was properly repaired and that the repair did not affect calibration. This may include performing parameter verification.

c. Items shipped to or from off-base support shall be reviewed for operation, damage, documentation, and compliance with TO 33K-2-11.

9.4 STANDARD REVIEW. The SR is a complete review of standards certified by PMEL and used to calibrate other TMDE. The SR alone does not sample enough laboratory standards to assess overall quality. However, it does reveal product quality defects that may be the result of a faulty laboratory process. These defects point management toward areas that require further investigation using root cause analysis. A minimum of one percent of all in-use standards shall be selected at the beginning of each month and completed in the month selected. For PMELs with less than 100 standards, a minimum of one standard per month shall be selected and completed. The SR includes the following:

a. Safety compliance

b. Full parameter verification

c. Physical condition

d. Documentation

e. Traceability (e.g., standards, reports, technical data, environment, facility, etc.)

9.5 SAMPLING RATES. PMEL managers shall review QR and SR sampling rates quarterly. Consider adjusting rates when negative or positive quality trends are observed, when changes occur in the overall skill level of the workforce, or when there are changes in the TMDE workload.

9.6 PROCESS REVIEW. The PR is a management tool used to target PMEL processes for investigation and improvement. The PR is not a revival of the "over-the-shoulder" concept. The focus of the PR is to review the process. If a technician is observed performing a process incorrectly, the subsequent investigation should focus on why the technician was unable to properly perform the process.

9.6.1 The PR is not intended to be a laboratory performance measure and shall not be reported as such. Use the PR to proactively seek out and document procedural problems in order to correct them. PQA evaluators shall observe the selected process as it normally occurs and document any process improvement opportunities before intervening or making comment (except in the case of safety or imminent equipment damage).

9.6.2 Generate a PR as follows:

a. As a step in root cause analysis for every QR and SR critical nonconformity. The PQA evaluator shall observe the certifying technician perform the suspect process without divulging the nonconforming condition. The PR may include the entire calibration process, selected steps, or support processes as necessary to determine why the nonconformity occurred and if the normal process is sufficient. For example, a PQA evaluator discovers a spectrum analyzer to be out of tolerance for flatness; the PQA evaluator should observe the technician performing the flatness calibration to determine if the technician's process identifies the nonconformity and/or the process requires improvement. Interaction and discussion between PQA evaluator and technician should begin after the suspect task is completed.

b. All K-stamp holders shall participate in at least one PR of a calibration process every 12 months. Management shall ensure these PRs evaluate training and metrology skills appropriate to the technician's position (i.e., a full calibration of an item they typically calibrate). Again, this review is intended to discover faulty laboratory processes or identify training deficiencies.

c. At management's discretion to target any portion of any process. Examination of a process may involve one or more PRs as necessary to collect sufficient data.

9.7 NONCONFORMITY (NC). Assigned NC codes are used in trend analysis to determine the most significant problems in the PMEL. By acting on the most significant problems, management improves overall PMEL performance. An item or process may have more than one NC and each NC shall be assigned a NC code. There are four NC classifications:

a. Critical quality NC (QNC). Deficiencies discovered during QRs and SRs that affect safety, accuracy, reliability, or traceability. Root cause analysis must be performed.

b. Non-critical QNC. Minor QR or SR quality defects that may be tracked for trend analysis. The AFMETCAL program does not require PMELs to report non-critical NCs in their QP activity summary. The category is provided for the convenience of PMEL management.

c. Critical process NC (PNC). Deficiencies discovered during PRs that could affect safety, accuracy, reliability, or traceability. Used only by internal PMEL management to improve PMEL processes.

d. Non-critical PNC. Minor process defects that may be tracked for trend analysis. The AFMETCAL program does not require PMELs to report non-critical NCs in their QP activity summary. The category is provided for the convenience of PMEL management.

9.8 ROOT CAUSE (RC) ANALYSIS. Accurately classifying the RC code of identified NCs is an important step in the QP. The assigned RC codes are used in trend analysis to determine the most frequent cause of problems in the PMEL. By eliminating or reducing the most significant cause of problems, management improves overall PMEL quality performance. RC codes shall be assigned to all critical NCs. RC analysis is simply applying appropriate steps of the Process Improvement Model to the NC and determining the most accurate RC code. Supervisors and PQA evaluators, and the process owner (normally), perform the analysis. For QRs and SRs, the NC is found after the fact and your analysis relies on the technical expertise and experience available in your PMEL. For PR NCs, the RC is often directly observed by the PQA evaluator. Make every effort to determine the true root cause of the NC and not just a symptom. Avoid simply restating the NC. Usually one "action or inaction" appears to be responsible, but a good RC analysis will address what caused the "action or inaction". Documentation of RC analysis should concisely explain how and why the RC code was selected and what was done to correct the nonconformity.

9.9 TREND ANALYSIS. Providing accurate data for trend analysis is absolutely critical. All the work done to this point in the QP is wasted unless management is provided the most accurate NC and RC codes. PMEL management shall periodically review the data collected by the QP and track the most frequent QNC, PNC, and associated RC codes. The use of bar charts is recommended. Non-critical NC codes may also be tracked at the discretion of the manager. Using the Process Improvement Model, management shall act upon the most significant problems and causes in the PMEL. Trend analysis shall be performed and documented at least quarterly.

9.10 PROCESS IMPROVEMENT MODEL. The process improvement model is only a tool that will help you find the most accurate root cause code and will also help management analyze laboratory trends. During RC analysis, use steps 'a' through 'c' to assign the RC analysis code. The emphasis in RC analysis is to reach the most accurate RC code. During trend analysis use all steps to analyze and correct the biggest laboratory NCs and RCs. The improvement model includes the following steps:

a. State the NC or trend.

b. List possible causes for the NC or trend.

c. Select the most probable cause for the NC or trend.

d. Propose corrective action(s) that will eliminate or minimize the root cause or trend.

e. Select the corrective action most likely to eliminate or minimize the root cause or trend.

f. Implement selected corrective action.

g. Follow-up and assess the effectiveness of the corrective action. Return to step 'e' if the corrective action was not effective.

h. Standardize the corrective action within the PMEL. This step may include updating training plans and/or operating procedures to ensure personnel are familiar with new procedures.

9.11 REPORTING REVIEWS. QR, SR, and PR review forms shall be designed to meet the objective of the applicable review. Retain review forms with critical NCs. The results of each review, with or without NCs, shall be recorded in the PAMS QP log or alternate system. File PRs generated from QR and SR nonconformities with the originating QR or SR. File PRs generated on individuals in a separate PR file. The review documentation for critical NCs shall include the appropriate steps of the process improvement model and shall specifically state if recall of TMDE was initiated or reasoning for not performing a recall. The PQA evaluator shall record the NC and RC codes in PAMS QP Log or alternate system and forward the review form per local procedures as outlined in the PMEL QM. PMEL management shall sign or initial all review forms containing critical NCs and approve/disapprove corrective actions. PMEL management shall document the process for routing of NC review forms in the PMEL QM. All review worksheets shall identify the ID number, Part Number, serial number, and work order/job control number (JCN) as applicable of the TMDE.

9.12 QP ACTIVITY SUMMARY. A monthly QP activity summary shall be created and maintained for a minimum of two years or the next AFMETCAL Assessment, whichever is longer. This document is to include the following:

a. QR.

1) Total production subject to QR.

2) Total number of items selected for QR.

3) Total number of QRs completed.

4) Percent of total production selected for QR.

5) QR items with critical nonconformities (bar code number and nonconformity codes).

b. SR.

1) Total number of in-use laboratory standards (calibrated by the laboratory).

2) Total number of SRs completed.

3) Percent of laboratory owned and certified standards selected for SR.

4) SR items with critical nonconformities (bar code number and nonconformity codes).

c. PR. List of PRs completed.

d. List of all bypassed reviews with justification.

e. Total number of certifying technicians (all personnel issued "K" stamps).

9.13 NONCONFORMITY AND ROOT CAUSE CODES. Codes shall be assigned to each identified critical nonconformity and its respective root cause. The purpose of assigning codes is to group similar nonconformities and root causes for trending. Standard nonconformity and root cause codes are listed in table 9-1. These specific codes shall not be changed. However, PMEL managers are authorized to expand on QP codes for local use, for example: "A01" The item is unsafe or hazardous to use. "A01d" could represent "Strap ties not cut flush" or another category useful to your trend analysis. Recommend using your collected QP data to group your most frequent NCs into subcodes rather than diluting your trend data with a large number of subcodes with one or two NCs in each subcode.

TABLE 9-1

SUMMARY OF QP CODES

NONCONFORMITY (NC) CODES:

Critical QNC Codes

A01	The item is unsafe or hazardous to use.
A01a	Item has hazardous foreign object inside (could result in damage or injury).
A01b	Item does not comply with T.O. 33-1-32.
A01c	Item is over-fused.
A02	The item is completely inoperative.
A03	The item has a function that is inoperative.
A04	The item does not meet calibration uncertainties for all parameters certified.
A05	The item has a physical defect that affects accuracy or reliability.
A06	The item is not clean and its condition could affect accuracy, reliability, or traceability.
A07	The item has a documentation error that affects accuracy or traceability.
A07a	Item is missing a T.O. directed limitation/annotation that affects safety, accuracy, or traceability.
A07b	Date due extended beyond CMS, K-100, or T.O. interval.
A07c	Item incorrectly identified.
A07d	Item certified better than calibration authority specifications or laboratory capability.
A08	The item has an intermittent function that affects accuracy, reliability, or traceability.
A09	The traceability chain is broken (standards, technical data, calibration report, etc.).

Non-Critical QNC Codes

B01	The item has a minor safety related defect.
B01a	Item has non-hazardous foreign object inside.
B02	The item is completely inoperative.
B03	The item has a function that is inoperative.
B04	Reserved.
B05	The item has a physical defect that does not affect accuracy or reliability.
B06	The item is not clean (does not affect accuracy, reliability, or traceability).
B07	The item has a documentation error that does not affect accuracy or traceability.
B08	The item has an intermittent function that does not affect accuracy, reliability, or traceability.
B09	Traceability chain potentially broken (standards, technical data, calibration report, etc.)

Critical PNC Codes

L01	Technical data incorrect, including calibration procedure, maintenance TO, commercial data, CPIN, etc. (use following subcodes when more accurate)
L01a	Wrong technical data used or technical data not current.
L01b	Technical data used contained an error requiring an AFTO Form 22. (affects safety, accuracy, reliability, or traceability)
L01c	Automated program/calibration software not validated/verified.
L01d	Automated program/calibration software otherwise incorrect.
L03	Incoming or outgoing inspections were not performed or incorrectly performed. (affects safety, accuracy, reliability, or traceability [FOD, T.O. 33-1-32, T.O. 33K-2-11,etc.]).)
L05	Complete calibration could not be performed (affects safety, accuracy, or traceability).
L06	Standard not used properly. (use following subcodes when more accurate).
L06a	Overdue or uncalibrated standard used.
L06b	Standard incorrectly substituted or test uncertainly ratio not maintained.
L06c	Standard not standardized or incorrectly standardized.
L06d	Standard not configured properly (incorrect setup, settings, connections, cables, loads, etc.).
L06e	Uncalibrated standard used for quantitative measurements (CBU, NCR, ICO w/o source data, etc.).
L06f	Laboratory does not possess standard required for certified specification.
L06g	Standard commercially calibrated without AFMETCAL approval.
L07a	Environment not considered (ignored or not monitored).
L07b	Item was calibrated during an out-of-tolerance environmental condition (affects accuracy).
L07c	Environmental data not properly documented (environmental chares, certification labels, etc.).
L08	Calibration fixtures, accessories, or tools not used or improperly used.
L09	Technician not task qualified (documentation of skills, training, experience).
L10a	Critical step, note, or caution improperly performed, not accomplished, ignored, or misinterpreted (affect safety, accuracy, reliability, or traceability).
L11	Technician failed to identify out-of-tolerance condition or incorrectly identified in-tolerance indication as out-of-tolerance.
L12	Test instrument certified better than calibration authority specifications.
L13	Test instrument missing mandatory or T.O. directed limitation.
L14	Calculations not performed or improperly performed.
L15	Calibration factors or correction charts not used, improperly used, or not accomplished.

Non-Critical PNC Codes

L02	Current technical order not used, or technical order used contained an error requiring an AFTO Form 22 (does not affect safety, accuracy, reliability, or traceability).
L04	Incoming or outgoing inspections not performed or performed incorrectly (does not affect safety, accuracy, reliability, or traceability).
L07d	The item was calibrated during out-of-tolerance environmental condition.
L08	Calibration fixtures, accessories, or tools not used or were improperly used.
L10b	Non-critical step, note, or caution improperly performed, not accomplished, ignored, or misinterpreted.
M01	Item in "Awaiting Parts" status an excessive amount of time.
M02	Replaced parts not documented in MDC.
M03	Incorrect UJC or SRD codes used when ordering parts.
M04	Deficiency report (DR) not submitted for defective parts of defective new item.
M05	Incorrect part(s) ordered or received.
M06	Part(s) or order an excessive amount of time with no follow-up action.
M07	Part(s) available on bench stock, shop stock, or work order residue not used.
P01	Item received dirty or had physical defects that were not documented.
P02	Item received without required documentation, technical data, or accessories.
P03	Item received overdue calibration an excessive amount of time.
P04	Item in Awaiting Maintenance, Hold, or Deferred status an excessive amount of time.
P05	Item not properly identified in database.
P05a	Part number not in CMS or T.O. 33K-1-100-2 and AFTO Form 45 not submitted.
P05b	Part number not purged from local K100 (when listed in CMS or T.O. 33K-1-100-2).
P05c	CMS not used or incorrectly used.
P05d	Data field incorrect.
P06	Item remained in Awaiting Customer status an excessive amount of time.
P07	Item not properly documented or improperly packaged for off-base shipment.
P08	Maintenance schedules or master listings incorrect, not updated, or late.
P09a	PMEL coordinator information incorrect.
P09b	PMEL coordinator training not accomplished.
P10	Item improperly handled or stored in laboratory.

Review Status Codes

N00	No Defect.
N01	Review in process - not completed.
N03	Review in process over 30 days – not completed.

ROOT CAUSE (RC) CODES:

C01	Wrong or invalid calibration technical data used.
C01a	Process of validating technical data not followed or requires improvement.
C01b	Process of maintaining technical data/T.O. library not followed or requires improvement.
C02	Calibration technical data in error (qualified technician would not detect).
C03	Calibration technical data ambiguous (allows for more than one interpretation).
C03a	Technician aware of technical data ambiguity and did not submit AFTO Form 22.
C04	Technician misinterpreted technical data.
C05	Process for completing AFTO Form 22 not followed or requires improvement.
E01	Temperature monitoring process not followed or requires improvement.
E02	Humidity monitoring process not followed or requires improvement.
F01	Component failure caused degradation or hard failure (normal process would not find).
F02	Failure related to previous faulty maintenance or repair (normal inspection would not find).
F03	Failure related to thermal heating (not evident during normal warm-up).
H01	Human error: Used as last resort. When all equipment, technical data, training, and other factors are adequate. When another qualified technician would not have made the same error.
H02	Misconduct: When all equipment , technical data, training, and other factors are adequate. The technician is fully aware of all requirements, demonstrates task competency, and the process is correct as written. Another qualified technician would not have made the same error and there is clear evidence the technician consciously disregarded laboratory policy.
I01	Process inadequate or faulty: Used when root cause analysis indicates all other root cause codes are not applicable. Established laboratory process for accomplishing the task is faulty and will be changed as a result of the root cause analysis.
S01	Standard out of tolerance (normal use would not detect).
S02	Standard overdue calibration (process for scheduling standars not followed or faulty).
S03	Standard limited for the function or accuracy used (process for checking limitations or limiting standards not followed or requires improvement).
S04	Standard intermittently malfunctioning (common metrology practices would not detect).
S05	Accessories or calibration fixtures faulty (common metrology practices would not detect).
T01	OJT insufficient (trainer demonstrates task proficiency).
T01a	OJT not accomplished.
T02	OJT insufficient (trainer does not demonstrate task proficiency).
T03	Incorrect substitution of standards (process not followed or requires improvement).
T04	Basic technical school deficiency.
T04a	Basic technical training not accomplished (process for monitoring entry level trainees not followed or requires improvement).
T05	Advanced technical school deficiency.
T05a	Advanced technical training required but not accomplished (process for assigning specialized maintenance not followed or requires improvement)
T06	Mathematical skills deficiency.
T06a	Technician unable to calculate required accuracies.
T07	Technician does not demonstrate task competency (task certified in this laboratory).
T08	Technician does not demonstrate task competency (task certified elsewhere).
U01	User responsibility not accomplished (User not trained on responsibilities).
U02	User responsibility not accomplished (User trained on responsibilities).
U03	User did not receive schedules, listings, or documentation required to fulfill responsibilities (process not followed or requires improvement).
U04	Unique mission requirements precluded User from accomplishing responsibilities (PMEL provided maximum assistance and process normally adequate).
U05	User performed unauthorized maintenance on certified test instrument.

SECTION 10

AIR FORCE METROLOGY AND CALIBRATION LABORATORIES

10.1. MAJOR COMMAND (MAJCOM) and AGENCY CODES .

Table 10-1
MAJCOM and AGENCY CODES

MAJCOM/AGENCY		CODE
Air Combat Command	(ACC)	1C
Air Education and Training Command	(AETC)	0J
AF Material Command	(AFMC)	1M
AF Reserves Command	(AFRC)	0M
AF Special Operations Command	(AFSOC)	0V
AF Space Command	(AFSPC)	1S
Air Intelligence Agency	(AIA)	0U
Air Mobility Command	(AMC)	1L
Air National Guard	(ANG)	4Z
Pacific Air Forces	(PACAF)	0R
US Air Force Academy	(USAFA)	0B
US Air Forces in Europe	(USAFE)	0D

10.2. AIR FORCE PRIMARY STANDARDS LABORATORY (AFPSL) . Table 10-2 contains AFPSL basic information. Address is AFPSL, 813 Irving-Wick Dr. W, Ste 4M, Heath OH 43056-6118.

Table 10-2
AFPSL SITE INFORMATION

SITE NUMBER	LAB LOCATION	BASE Code	PMEL Type	MAJ COM	CMD Code	68ºF Rm(D)	JETSC (#)	TFCU (*)	Remarks
A001	AFMETCAL Det 1 Heath, OH	RRTC	AFPSL	AFMC	1M	D			Contract

10.3. PRECISION MEASUREMENT EQUIPMENT LABORATORIES (PMELs). Table 10-3 contains the assigned PMEL NUMBER and basic site information for all Air Force PMELs.

Table 10-3
PMEL SITE INFORMATION

SITE NUMBER	PMEL LOCATION	BASE Code	PMEL Type	MAJ COM	CMD Code	68ºF Rm(D)	JETSC (#)	TFCU (*)	Remarks
P001	Altus AFB OK	AGGN	IIB	AETC	0J				MEO
P002	Andersen AFB, Guam	AJJY	IIB	PACAF	0R		#		Contract
P003	Andrews AFB MD	AJXF	IIB	AMC	1L		#		MEO
P004	Arnold AFB TN	ANZW	IIC	AFMC	1M	D			Contract
P005	Aviano AB, Italy	ASHE	IIB	USAFE	0D		#	***	CORE
P006	Barksdale AFB LA	AWUB	IIB	ACC	1C		#		Contract
P007	Beale AFB CA	BAEY	IIB	ACC	1C		#		Contract
P008	Brooks AFB TX	CNBC	III	AFMC	1M				Contract
P009	Cannon AFB NM	CZQZ	IIB	ACC	1C		#		Contract
P010	Cape Canaveral AFS FL	DBEH	IIC	AFSPC	1S	D			Contract
P011	Cavalier AFS ND	EGYN	III	AFSPC	1S				Contract
P012	Charleston AFB SC	DKFX	IIB	AMC	1L		#		CORE
P013	Clear AFS AK	DXEB	III	AFSPC	1S				Contract

SITE NUMBER	PMEL LOCATION	BASE Code	PMEL Type	MAJ COM	CMD Code	68ºF Rm(D)	JETSC (#)	TFCU (*)	Remarks
P014	Columbus AFB MS	EEPZ	IIB	AETC	0J		#		Contract
P015	Davis Monthan AFB AZ	FBNV	IIB	ACC	1C		#	*	CORE
P016	Dover AFB DE	FJXT	IIB	AMC	1L				MEO
P017	Duluth IAP MN	FMKM	IIB	ANG	4Z		#	*	CORE
P018	Dyess AFB TX	FNWZ	IIB	ACC	1C		#		Contract
P019	Edwards AFB CA	FSPM	IIC	AFMC	1M	D	#	*	CORE
P020	Eglin AFB FL	FTFA	IIC	AFMC	1M	D	#		CORE
P021	Eielson AFB AK	FTQW	IIB	PACAF	0R		#		Contract
P022	Ellsworth AFB SD	FXBM	IIB	ACC	1C		#		Contract
P023	Elmendorf AFB AK	FXSB	IIA	PACAF	0R	D	#	*	Contract
P024	F.E. Warren AFB WY	GHLN	IIB	AFSPC	1S				Contract
P025	Fairchild AFB WA	GJKZ	IIB	AMC	1L		#		Contract
P026	Feltwell RAF UK	MSET	IIA	USAFE	0D	D	#	****	Contract
P027	Forbes Field KS	GUQG	IIB	ANG	4Z		#	*	CORE
P028	Grand Forks AFB ND	JFSD	IIB	AMC	1L		#		Contract
P029	Hickam AFB HI	KNMD	IIB	PACAF	0R		#	*	Contract
P030	Hill AFB UT (OOALC)	SGQM	IIA	AFMC	1M	D	#	***	Contract
P031	Holloman AFB NM	KWRD	IIC	ACC	1C	D	#	*	CORE
P032	Kadena AB JA	LXEZ	IIA	PACAF	0R	D	#		CORE
P033	Keesler AFB MS	MAHG	IIB	AETC	0J				Contract
P034	Kirtland AFB NM	MHMV	IIC	AFMC	1M	D	#		MEO
P035	Kunsan AB ROK	MLWR	IIB	PACAF	0R		#	*	CORE
P036	*-Reserved-*								
P037	Langley AFB VA	MUHJ	IIB	ACC	1C		#	*	CORE
P038	Laughlin AFB TX	MXDP	IIB	AETC	0J		#		CORE
P039	Little Rock AFB AR	NKAK	IIB	AETC	0J		#		CORE
P040	Luke AFB AZ	NUEX	IIB	AETC	0J		#		CORE
P041	MacDill AFB FL	NVZR	IIB	AMC	1L		#		Contract
P042	Malmstrom AFB MT	NZAS	IIB	AFSPC	1S		#	*	Contract
P043	Maxwell AFB Gunter Annex AL	JUBJ	IIB	AETC	0J		#		Contract
P044	McChord AFB WA	PQWY	IIB	AMC	1L		#	*	CORE
P045	McConnell AFB KS	PRQE	IIB	AMC	1L		#	*	Contract
P046	McGuire AFB NJ	PTFL	IIB	AMC	1L		##	**	CORE
P047	Minot AFB ND	QJVF	IIB	ACC	1C		#		Contract
P048	Misawa AB JA	QKKA	IIB	PACAF	0R		#	*	CORE
P049	Moody AFB GA	QSEU	IIB	ACC	1C		#		Contract
P050	Mt Home AFB ID(w/1 RASCAL)	QYZH	IIB	ACC	1C		#	**	CORE
P051	Nellis AFB NV	RKMF	IIB	ACC	1C		#	*	CORE
P052	New Boston AFS NH	RNGF	III	AFSPC	1S				Contract
P053	Offutt AFB NE	SGBP	IIB	ACC	1C		#		Contract
P054	Osan AB ROK	SMYU	IIB	PACAF	0R		#	*	CORE
P055	Otis ANGB MA	SPBQ	IIC	ANG	4Z	D	#	*	CORE
P056	Patrick AFB FL	SXHT	IIB	AFSPC	1S			***	Contract
P057	Peterson AFB CO	TDKA	IIB	AFSPC	1S		#		Contract
P058	Pope AFB NC	TMKH	IIB	AMC	1L		#		MEO
P059	Ramstein AB GE	TYFR	IIB	USAFE	0D		#	*	CORE

SITE NUMBER	PMEL LOCATION	BASE Code	PMEL Type	MAJ COM	CMD Code	68ºF Rm(D)	JETSC (#)	TFCU (*)	Remarks
P060	Randolph AFB TX	TYMX	IIB	AETC	0J		#		CS
P061	Robins AFB GA (WRALC)	UHJC	IIA	AFMC	1M	D	#	*	Contract
P062	Scott AFB IL	VDYD	IIB	AMC	1L		#	*	MEO
P063	Selfridge ANGB MI	VGLZ	IIB	ANG	4Z		#	*	CORE
P064	Seymour Johnson AFB NC (w/1 RASCAL)	VKAG	IIB	ACC	1C		#	**	CORE
P065	Shaw AFB SC	VLSB	IIB	ACC	1C		#	*	CORE
P066	Sheppard AFB TX	VNVP	IIB	AETC	0J		#		Contract
P067	Thule AB GL	WWCX	IIB	AFSPC	1S				Contract
P068	Tinker AFB OK (OCALC)	SHDF	IIA	AFMC	1M	D		*	Contract
P069	Travis AFB CA	XDAT	IIB	AMC	1L		#	**	CORE
P070	Tyndall AFB FL	XLWU	IIB	AETC	0J		#		Contract
P071	USAF Academy CO	XQPZ	IIB	USAFA	0B				MEO
P072	USNS Observation Island	n/a	III	ACC	1S			**	Contract
P073	Vance AFB OK	XTLF	IIB	AETC	0J		#		Contract
P074	Vandenberg AFB CA	XUMU	IIC	AFSPC	1S	D			Contract
P075	Whiteman AFB MO	YWHG	IIB	ACC	1C				Contract
P076	Wright-Patterson AFB OH	ZHTP	IIC	AFMC	1M	D		***	Contract
P077	Yokota AB JA	ZNRE	IIB	PACAF	0R		#	*	CORE

NOTE: "D" - The "D" indicates PMELs authorized a 68°F Dimensional Room.
"#" - The number of "#"s indicates JETSCs owned by the PMEL.
"*" - The number of "*"s indicates TFCUs owned by the PMEL.

Remarks: CS – Civil Servant Operated
MIL – Military Operated
CORE – Core PMEL, Military
MEO – MEO Operated

10.4. AUTHORIZED USER TORQUE CALIBRATION AND REPAIR SITES : Table 10-4 contains the assigned Site Number and basic site information for all authorized torque calibration and repair sites.

Table 10-4
TORQUE SITE INFORMATION

SITE NUMBER	TORQUE SITE LOCATION	CMD	ORGANIZATION	LIMITATION / REMARKS	LOCAL GRAVITY (MILLIGALS)
T003	Atlantic City (NJ)	ANG	177FW/LGMVA	0.0 - 2000 FtLb, 2% Min Accuracy.	980.1240
T029	Bangor ANGB (Bangor ME)	ANG	101ARW/	0.0 – 2000 FtLb, 2% Min Accuracy.	980.576
T031	Barnes ANGB (Westfield MA)	ANG	104FW/LGMV	0.0 - 1000 FtLb, 2% Min Accuracy.	980.34126
T035	Battle Creek ANGB (MI)	ANG	110MXS/LGMVG	0.0 - 2000 FtLb, 2% Min Accuracy.	980.29336
T037	Birmingham IAP (AL)	ANG	117ARW/MXS	0.0 - 1000 FtLb, 2% Min Accuracy.	979.52234
T030	Bradley IAP (East Granby CT)	ANG	103FW/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	980.337
T006	Buckley AFB (CO)	ANG	140LG/LGMVP	0.0 - 250 FtLb, 2% Min Accuracy.	979.59594
T021	Burlington IAP (VT)	ANG	158FW/LGMV	0.0 - 250 FtLb, 2% Min Accuracy.	980.50281
T014	Capital MAP (Springfield IL)	ANG	183FW/LGMVA	0.0 - 2000 FtLb, 2% Min Accuracy.	980.06743
T047	Carswell JRB (Fort Worth TX)	ANG	136MXS/LGMVG	0.0 - 250 FtLb, 2% Min Accuracy.	979.456

SITE NUMBER	TORQUE SITE LOCATION	CMD	ORGANIZATION	LIMITATION / REMARKS	LOCAL GRAVITY (MILLIGALS)
T051	Channel Island AGS (Port Hueneme CA)	ANG	146MXS/LGMCA	0.0 - 1000 FtLb, 2% Min Accuracy.	979.65301
T050	Charlotte-Douglas IAP (NC)	ANG	145AW/MXS	0.0 - 1000 FtLb, 2% Min Accuracy.	979.71193
T053	Cheyenne MAP (WY)	ANG	153AW/LGMVG	0.0 - 1000 FtLb, 2% Min Accuracy.	979.68648
T007	DesMoines (IA)	ANG	132FW/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	980.18361
T016	Ebbing ANGB (Fort Smith MAP AR)	ANG	188FW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.68333
T020	Ellington Field (Houston TX)	ANG	147FW/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	979.27466
T009	Fort Wayne (IN)	ANG	122FW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.18688
T005	Fresno (CA)	ANG	144MXS/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	979.82178
T042	Gen Mitchell ANGB (Milwaukee WI)	ANG	128ARW/MXS	0.0 - 1000 FtLb, 2% Min Accuracy.	980.34114
T041	Gowen Field (Boise ID)	ANG	124MXS/	0.0 - 2000 FtLb, 2% Min Accuracy.	980.194
T012	Great Falls (MT)	ANG	120FW/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	980.49770
T027	Hancock Field (Syracuse NY)	ANG	174FW/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	980.38216
T067	Harrisburg IAP (PA)	ANG	193SOW/LGMVG	0.0 - 250 FtLb, 2% Min Accuracy.	980.11544
T011	Hector Field (Fargo ND)	ANG	119FW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.71334
T010	Jacksonville (FL)	ANG	125FW/LGMVP	0.0 - 250 FtLb, 2% Min Accuracy.	979.37442
T002	Joe Foss Field (Sioux Falls SD)	ANG	114FW/LGMVA	0.0 - 2000 FtLb, 2% Min Accuracy.	980.34805
T026	Kelly ANG (San Antonio TX)	ANG	149FW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.19380
T066	Key Field (Meridian MS)	ANG	186ARW/	0.0 - 1000 FtLb, 2% Min Accuracy.	979.46872
T013	Kingsley Field (Klamath Falls OR)	ANG	173FW/LGMVT	0.0 - 250 FtLb, 2% Min Accuracy.	979.96515
T063	Kulis AGB (Anchorage AK)	ANG	176WG/MXS	0.0 - 1000 FtLb, 2% Min Accuracy.	981.90288
T008	Lambert IAP (St Louis MO)	ANG	131FW/LGMA	0.0 - 2000 FtLb, 2% Min Accuracy.	979.98764
T054	Lincoln MAP (NE)	ANG	155ARW/	0.0 - 2000 FtLb, 2% Min Accuracy.	980.15899
T040	Louisville IAP (KY)	ANG	123AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	979.94283
T064	Mansfield-Lahn AP (OH)	ANG	179AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	980.13092
T056	March AFB (CA)	ANG	163ARW/LGMV	0.0 - 2000 FtLb, 2% Min Accuracy.	979.486
T045	Martin SAP-135th (Baltimore MD)	ANG	135AG/	0.0 - 250 FtLb, 2% Min Accuracy.	980.10363
T062	Martin SAP-175th (Baltimore MD)	ANG	175WG/	0.0 - 2000 FtLb, 2% Min Accuracy.	980.10363
T059	Martinsburg RAP (WV)	ANG	167AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	980.02011

SITE NUMBER	TORQUE SITE LOCATION	CMD	ORGANIZATION	LIMITATION / REMARKS	LOCAL GRAVITY (MILLIGALS)
T024	McEntire ANGB (SC)	ANG	169FW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.61301
T044	Minn St Paul IAP (MN)	ANG	133AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	980.58015
T046	Moffett FAF (CA)	ANG	129RQW/MXS	0.0 - 250 FtLb, 2% Min Accuracy.	979.92964
T017	Montgomery RAP (AL)	ANG	187FW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.49259
T055	Muniz ANGB (PR)	ANG	156AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	978.67471
T038	Nashville MAP (TN)	ANG	118AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	979.76761
T058	New Castle CAP (DE)	ANG	166AW/	Authorization on hold pending facility upgrade.	980.16328
T004	New Orleans (LA)	ANG	159MS/AIS	0.0 - 250 FtLb, 2% Min Accuracy.	979.30931
T033	Niagara Falls ANG (NY)	ANG	107ARW/	0.0 – 2000 FtLb, 2% Min Accuracy.	980.37581
T073	Pease ANGB (Portsmouth NH)	ANG	157ARW/	0.0 - 2000 FtLb, 2% Min Accuracy.	980.450
T065	Peoria AP (IL)	ANG	182AW/MXs	0.0 - 250 FtLb, 2% Min Accuracy.	980.14997
T060	Pittsburgh IAP (PA)	ANG	171ARW/	0.0 - 500 FtLb, 2% Min Accuracy.	980.08508
T001	Portland IAP (OR)	ANG	142FW/LGMVA	0.0 - 600 FtLb, 2% Min Accuracy.	980.63196
T068	Quonset ANGB (N Kingstown RI)	ANG	143AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	980.29734
T052	Reno-Tahoe IAP (NV)	ANG	152AW/LGMV	0.0 - 1000 FtLb, 2% Min Accuracy.	979.67276
T019	Richmond IAP (VA)	ANG	192FW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.94519
T049	Rosecrans ANGB (St Joseph MO)	ANG	139MXS/	0.0 - 1000 FtLb, 2% Min Accuracy.	980.04466
T072	Salt Lake City (UT)	ANG	151ARW/	0.0 - 2000 FtLb, 2% Min Accuracy.	980.804
T057	Savannah IAP (GA)	ANG	165AW/	0.0 - 1000 FtLb, 2% Min Accuracy.	979.48474
T018	Sioux Gateway IAP (Sioux City IA)	ANG	185FW/LGMCVA	0.0 - 250 FtLb, 2% Min Accuracy.	980.29240
T015	Springfield MAP (OH)	ANG	178FW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.05680
T034	Stratton ANGB (Scotia NY)	ANG	109AW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.34799
T061	Thompson Field (Jackson MS)	ANG	172AW/	0.0 - 250 FtLb, 2% Min Accuracy.	979.49326
T023	Toledo EAP (OH)	ANG	180FW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.21689
T028	Truax Field (Madison WI)	ANG	115FW/	0.0 - 250 FtLb, 2% Min Accuracy.	980.35841
T025	Tulsa IAP (OK)	ANG	138MXS/LGMVA	0.0 - 250 FtLb, 2% Min Accuracy.	979.76148
T048	Will Rogers ANGB (Oklahoma City OK)	ANG	137MXS/LGMVG	0.0 - 250 FtLb, 2% Min Accuracy.	979.65157
T036	Willow Grove ARS (PA)	ANG	111FW/LGMV	0.0 - 250 FtLb, 2% Min Accuracy.	980.142

SITE NUMBER	TORQUE SITE LOCATION	CMD	ORGANIZATION	LIMITATION / REMARKS	LOCAL GRAVITY (MILLIGALS)
T043	Yeager AP (Charleston WV)	ANG	130AW/MXS	0.0 - 1000 FtLb, 2% Min Accuracy.	979.91682